The
GEOGRAPHICAL JOURNAL

Vol CXXIII Part 4 *December 1957*

THE EXPLORATION OF HUAGARUNCHO: A PERUVIAN JOURNEY

I. TRAVELS AND CLIMBING OF THE ADVANCE PARTY

G. C. BAND

THE HIGHEST PEAKS outside the Himalaya are those of the Andes, and many still wait to be climbed. They range for over 6000 miles from Venezuela to Cape Horn—as far as the North Pole is from the centre of the Sahara, or London from Mount Everest. True, many of the summits are dull, rounded volcanoes, but the core of the chain is granitic and forms ice-fluted peaks of incredible beauty. The finest are in Peru. What a land of contrast it is! Between the Pacific coast and the primeval forests of the Amazon lie sandy deserts and sun-scorched rocks; fertile plains planted with cotton and sugar-cane; two mountain chains enclosing the windswept Altiplano—too high for corn but rich in minerals and with grazing enough for sheep, llamas, alpacas, and the rare vicuna.

Protected by the inner ranges is Cuzco, ancient capital of the Inca Empire. In A.D. 1532 it was overthrown by a handful of Spaniards, led by the bold and illiterate soldier Francisco Pizarro. Two years later he founded Lima, the present capital of Peru. "Amid the woe and destruction which Pizarro and his followers brought on the devoted Land of the Incas," says Prescott, "Lima, the beautiful City of the Kings, survives as the most glorious work of his creation, the fairest gem on the shores of the Pacific." To this great city there arrived in May 1956 the advance party of the Huagaruncho expedition comprising Jack Tucker, John Streetly, Dr. Stafford Matthews and myself. Later, for the attempt on Huagaruncho, we were to be reinforced by Michael Westmacott and the leader, John Kempe. All but one of our party had climbed in the Himalaya, either on Everest or Kangchenjunga.

Because of a predominating interest in the Himalaya, British climbers have tended to neglect the Andes in recent years, and left them as a playground for the Austrians, Americans, Germans, Swiss, French, Belgians and Dutch. But now that most of the world's highest peaks have been scaled, mountaineers can regain a sense of proportion, returning to moderate altitudes where oxygen is not so scarce, and enjoy their climbing once again, tackling peaks for their sheer beauty or for their technical difficulty, or for any reason they may wish.

The four of us had come earlier to Peru so that we might visit as many ranges as possible, travel widely and, particularly, inspect the Inca handiwork at Cuzco. A blanket of cloud and sea-mist covers Lima for eight months of the year, and we

were glad to fly out into the sunshine of Arequipa on the first leg of our journey to Cuzco. All the picture postcards show Arequipa nestling beneath the perfect snow-capped cone of El Misti, 19,200 feet high, but for once the mountain was bare. In a whole year of drought there had been only two hours of rain in the town.

The British-operated Peruvian railways very generously offered us free transport, so we chose this roundabout route rather than fly direct to Cuzco. It boasts the highest standard-gauge railway in the world—15,806 feet 9 inches above sea level—and probably the tightest curves as well. At the larger wayside halts we were pressed to buy hand-made woollen goods from the women, who wore brightly coloured shawls and, in ridiculous contrast, dusty bowlers or "derby" hats. One wonders who was the super-salesman that introduced this bizarre headgear. At dusk we reached Puno on the shores of Lake Titicaca. The Incas believed this lake to be the birthplace of their civilization, and that Viracocha, their god, emerged from its waters to create heaven and earth. Today, isolated colonies of the Uru Indians live on "floating" islands in the lake; in the shallow reedy waters they build huts of reeds on the soft, spongy foundation. The lake teems with fish which they catch from their *balsas*—canoes made entirely from the *totora* reeds lashed together in four great bundles. Since trout were introduced into Titicaca in the 1930's they have grown as large as any in the world. In the market, 30-inch, 20-lb. rainbow and salmon trout were commonplace.

We arrived in Cuzco just in time for the Fiesta of Corpus Christi. From the Cathedral, huge statues were carried shoulder-high by teams of Indians, and paraded around the Plaza de Armas with an ear-splitting accompaniment of trumpets, drums, conch shells and flutes. Three weeks later, on June 24, Mid-winter's Day, we were present at Inti Raymi. In former Inca times this, their most important feast, commemorated the winter solstice, when the sun, the god whom they worshipped, took its most northern course, and the people feared they might lose its warmth for ever. But the High Priest chose the day with astro-nomical care, and by worship, ceremony and sacrifice, he persuaded the sun to return, and the people sang and danced for joy. Nowadays, on June 24, Cuzco is in carnival. In narrow streets between the indestructible Inca walls, bare-footed Indians in red-striped ponchos and platter-shaped hats jostle with brash American tourists and tight-lipped cameramen. For each other's benefit they dance and sing, film and stare, and, at the fortress of Sacsahuaman overlooking the town, players re-enact the pageant of Inti Raymi.

Between these two orgies, we visited one of the least known mountain regions in Peru, the Cordillera Vilcabamba, 100 miles north-west of Cuzco. The inner ranges had never been visited by mountaineers or adequately surveyed; existing maps showed the principal peak to be Pumasillo—the puma's claw—at 20,492 feet perhaps the highest unclimbed peak in Peru. But despite the confidence with which its height was asserted, there was doubt about its exact location, and many hand-some mountains, seen by climbers from a distance, remained unnamed. To Huadquina, we took the narrow-gauge railway which runs through the deep wind-ing gorge of the Urubamba. Although inured to Himalayan heights and depths, I was astonished by the immense ravines. Tremendous granite walls a mile high rose sheer from the foaming, roaring rapids, and luxuriant vegetation grew and hung from every niche and ledge.

It was here, on a drizzly June day in 1911, and after a long climb up slippery grass and greasy crags, that Hiram Bingham with an Indian guide came across ruined houses built of the finest Inca stone-work. Fine-grained granite ashlars

carefully cut were exquisitely fitted together; the upper courses, diminishing in size towards the top, lending grace and delicacy to the solid structure. He called this lost city Machu Picchu after the ridge on which it was built. "Undoubtedly," he asserts, "in its last state the city was the carefully guarded treasure-house where that precious worship of the sun, the moon, the thunder and the stars, so violently overthrown in Cuzco, was restored, where the last four Incas had their safest and most comfortable home and the chosen women whose lives had from early girlhood been devoted to all the duties of the Sanctuary found a refuge from the animosity and the lust of the *conquistadores*." Many archaeologists would not agree with Bingham, but Machu Picchu remains a place of mystery and wonder, and in its incredible isolation a monument to human audacity and pride.

The diversity of Huadquina, the present terminus of the narrow-gauge railway, was first described by the Comte de Sartiges in 1834 when he wrote that its owner "is perhaps the only landed proprietor in the entire world who possesses on his estates all the products of the four parts of the globe. In the different regions of his domain he has wool, hides, horsehair, potatoes, wheat, corn, sugar, coffee, chocolate, coca, many mines of silver-bearing lead, and placers of gold." Despite all this wealth, five *mañanas* had come and gone before Matthews, who generously waited behind, could engage a dozen mules to carry our equipment.

The rest of us went ahead, impatient and lightly laden, to explore the range. We seemed a long way from it. The railway had brought us down in a series of switchbacks to 5000 feet where the climate was tropical. Parakeets, humming birds, and an occasional scarlet cockatoo flashed across our path. Only rarely were we treated to a tantalizing glimpse of snow far up some distant valley. After another five days we pitched base camp at the head of a steep-sided valley. By rights we should only be a couple of miles from Pumasillo, although only one person of the many we asked had ever heard of it. We climbed a nearby rock peak as an observation point —now, where was Pumasillo? To the west, where it should have been, a small blunt pyramid raised itself apologetically. No luck. But to the east there was a big range of snow mountains. Excitedly we began tracing imaginary routes up each major peak. But that was as high as we got.

Later, when we camped on a snow saddle to the east, we saw that a new valley opened out between the peaks and ourselves. When we circumvented this an even wider and deeper chasm appeared. We needed several days to move round into an attacking position and this would leave us too little time in which to return to Cuzco. Chastened, and with a little more respect for Peruvian gorges, we returned by another route. Attracted by its elusiveness, we were thinking of going back again to Pumasillo, but in Cuzco we met some American climbers who had declared it their target. Since they had originally wanted to go to our main objective—Huagaruncho—but had stood back in our favour, we were happy to accede, and by telling them all we could, do our best to ensure their success. We heard later that they climbed some five peaks in this range, but there is still much scope for climbing and mapping and, upon our recommendation, a young party from Cambridge is going out there this summer (1957) to pursue the work.

We now had a period of three weeks before John Kempe would join us, so we decided to visit Peru's most famous range, the Cordillera Blanca, which has been well explored by Professor Kinzl's Austrian expeditions. Only a few unclimbed peaks remain, and of these we chose Pyramid, 19,600 feet, at the head of the Parron valley, nine miles north of the peak Huascaran. From the village of Caras, 40 miles down Rio Santa from Huaras, we coaxed our convoy of seven donkeys

up a dusty track. Near the top of the valley there is a moraine-dammed lake—Parron lake—over 2 miles long. It is rather a menace because, in an exceptional summer, the accumulating melt-water might burst the barrier and cause catastrophic floods. Indeed, the father of our three porters was drowned in a recent disaster of this kind, and now regular watch is kept upon the water levels. Unfortunately, the mountain walls on either side were so precipitous that it was not possible to climb around with our equipment; the only way was across the lake. We had borrowed a rubber dinghy from the Peruvian Air Force and, towing behind it a raft of air mattresses carrying our equipment, we rowed across the lake. We had to make several journeys, and, since we were at 14,000 feet and the wind seemed to be against us either way, I longed for the stamina of a rowing Blue. It was late that evening before everything was transported to the far side, where we camped beneath the only tree.

But luck was not with us on this trip. No sooner had we set up a couple of camps on the mountain than the weather clamped down. The east wind blew steadily and all day long the peak was smothered in cloud. It was colder than at similar altitudes in the Himalayas. Much snow fell. We retreated to Base Camp. After two days, when Westmacott had joined us, we reascended and Streetly and I occupied Camp III—a flimsy green tent in swirling mist and snow at 18,300 feet, about 1300 feet from the summit. We were attacking the north ridge which narrowed and rose to form a minor point 500 feet above. From there a cockscomb crest led to the summit.

On our last available day we set out for the top. It was one of the windiest days I have spent on a mountain. Then by 9 a.m. the cloudbank came swirling down upon us. In a moment we could no longer see where to go. Retreat was inevitable. Time was up; we had to return to civilization. We paddled back across Lake Parron with the fair-weather wind—the west one—against us all the way. We accomplished 2 miles in four hours. As the dinghy grounded on the moraine bank someone knocked aside a stone. To our amazement the lake water swirled down the hole beneath it like bath-water gurgling down the plug-hole. Next day it was still running away. Perhaps the next visitors won't need a dinghy after all. So much for messing about in boats. Now for Huagaruncho!

II. THE ASCENT OF HUAGARUNCHO

M. H. WESTMACOTT

Before we arrived in Peru, our information had been limited to the reports of two American parties which had visited the southern flank of Huagaruncho just before the war. The Peruvian Air Force very kindly made air photographs available to us on our arrival and, armed with these and a good supply of optimism, we set out for the mountain. We approached it from the south-east, largely because this way was known to be direct, and we were in a hurry to leave civilization before the onset of the national holiday, when all work was said to be impossible for two or three days.

After pitching a preliminary base camp by Lake Talenga, to the east of the mountain, we began to explore the area. Huagaruncho dominates all its neighbours. It is in the form of a tapering pyramid of ice, with contorted ridges descending to the south-east, north-east and west. The west ridge falls for some 3500 feet

to a depression which we called the west col, and then rises to a subsidiary peak of 17,856 feet—Peak 30. Four days' reconnaissance convinced us that the west ridge was our only hope, and we then took two days to move the whole expedition round to the north side of the mountain.

Having chosen what seemed to us the least improbable of the ridges of Huagaruncho, we had only to reach it and to climb it. We were optimistic. A day should be enough for us to find a way through the short icefall of the north-west glacier and to choose a camp site below the west col. The col itself might require some hard ice climbing, but the ridge should yield to a determined attack after one or two days. The day after we pitched our base camp, Band, Streetly and Tucker set off for the icefall. The same day, Kempe and I made a reconnaissance of Peak 30, and the view we had of the west ridge of Huagaruncho, from this different angle, was not encouraging. We revised our estimate of the time required for the ridge, but confidently expected that the others would have found a way to the foot of it by now. We returned to Base Camp, tired after a long day's struggle with snow that was waist-deep when we turned back at over 17,000 feet. We found the others despondent. After casting to right and left in search of a route, they had succeeded in climbing about 150 feet of the icefall. They thought that another 100 feet lay above them and that they could make a route up it, but they did not think it could be made practicable for porters. Next morning Base Camp was covered in snow and more continued to fall while we breakfasted. At about 10.30 the weather improved slightly and Band suggested that we might go out and look for an alternative route to the glacier, rather than stay brooding in camp. The two of us left at 11 o'clock and made our way up the boulder-strewn slopes above camp, towards the right-hand edge of the icefall. Avoiding the ice, we skirted a rock buttress to the right, searching for a way up it. The mist now came down on us again, but we decided to see how far we could go up an easy gully that we found up the side of the buttress.

Leaving cairns to mark our route, and keeping to the left to avoid *séracs* which we knew were poised on the slopes to our right, we scrambled up the rocks for about 300 feet. At the top of the buttress, much to our surprise, the way was open onto the glacier. The mist was now thick about us, and snow started to fall again. We could not tell which shelf of the glacier we had reached; we could not see the mountain; we only had in our mind's eye a general picture of the glacier as we had seen it on our first approach to the north side. Trusting to our sense of the contours of the mountain, we trudged upwards and across the slope, into the mist. After we had been going for twenty minutes, the snow came pelting down and we discussed turning back. We decided instead to have lunch and give the weather a chance to improve. As we spun out the last of our biscuits, the snow stopped and the mist thinned a little. We could see almost 200 yards to where a line of crevasses and short ice walls cut across the glacier. We were now fairly certain we must be on the main glacier itself. We trudged on, and were lucky enough to find a way straight through the obstacle and on to an upper shelf of the glacier. A few moments later there was a break in the clouds, a patch of blue sky ahead, and the sheer rock and ice of the west col appeared immediately above us. Making a dump of our spare rope and pitons, we returned gratefully to Base Camp along the route we had found. This was a day when things went unexpectedly well. Our spirits rose, and again we had thoughts of reaching the summit in two or three days. It was to take us twelve, and the outcome was to be in doubt until the last moment.

The next task was to establish a light camp on the upper shelf of the glacier, and to reach the col above it. Kempe, Matthews and the three porters carried the camp,

while Band, Streetly and Tucker made a route up the steep ice wall to reach the ridge just above the col. They fixed 200 feet of rope and then turned to the ridge itself. Their way was barred by an ice *gendarme* with vertical sides, so next day they explored to the left to see whether a route to avoid the difficulty could be made on the north side. Band spent three hours on what he thought was the hardest snow pitch of his life, led out 70 feet of rope, found himself unable to descend, and had to rope down from his ice-axe, leaving it behind. Kempe and I, having been again defeated by Peak 30, with only 200 feet to go, received his news gloomily when we met at Base Camp that night.

Kempe, Streetly and I now went up for two days' work above the glacier camp. The possibilities of the north side having been exhausted, we were now trying to avoid the first difficulties of the ridge on the steep and shaded slopes to the south of the col. On the first day, we crossed the col and descended to a small hanging glacier on the south. The hanging glacier led nowhere, and the only hope was to cross the *bergschrund* at the top of it and try the even steeper slopes above. We spent the remainder of that day on the crossing. The next day, we followed our previous tracks and started to traverse the steep slope above the *bergschrund*. We had none of us met such soft snow before, lying at such a high angle. The only method of tackling it was to carve a great ledge across, and to take advantage of occasional firm patches by driving in stakes to act as belays. At the end of six hours, we had advanced 150 feet across the mountain and 6 feet up it. There were about 3000 feet left to climb.

Next day Band and Tucker came up, and they extended our route round a steep and difficult ice corner, up under an ice wall, and then a short way up and across a slope which they thought was liable to avalanche. Having run out of rope, they returned for a fresh supply, but were prevented from making any progress next day by a storm which made it useless to leave camp. Streetly and I took over for the next two days. We spent most of the first morning clearing the fresh snow from the tracks so far made, and then pushed up the "avalanche slope." We put a stake deep in the snow half-way up, but neither of us could believe it was very safe and it was a great relief to reach solid ice at the top and to place a really firm ice peg for the first time in 300 feet. After a short rest, Streetly then traversed to the left and at 4 p.m. he had regained the crest of the west ridge at last. The next day we started early and attacked the ridge itself. It was steep, but for the first 200 feet there was no technical difficulty. Then there was a short ice wall, and a sensational pitch up a slender leaf of ice which overhung the south face. A dull slogging slope of deep snow followed, to the foot of an ice barrier about 150 feet high. Avoiding this on the left, we crossed a crevasse by a rather suspect bridge, and Streetly led straight up the ice wall beyond. Again there were exhausting slopes of deep snow until we arrived on a great shelf which ran right across the mountain some 700 feet below the summit. We spent an hour there before discovering what seemed to us the only possible route above the shelf, and then were forced reluctantly to call it a day and return to camp. Kempe, Band and Tucker were waiting to take over from us. They started just after dawn next day, reached our highest point at noon, and were then faced with a steep wall about 250 feet high. This took them four hours—first a hard ice pitch of about 20 feet, and then snow lying at a very high angle. Before they had reached the top of the wall, a storm blew up, it became very cold, and a blizzard hit them. At 4.30 they were forced to retreat. Darkness overtook them as they reached Streetly's ice wall, the steps were filled with snow, and they were forced to move very slowly and with extreme caution. Only the full moon

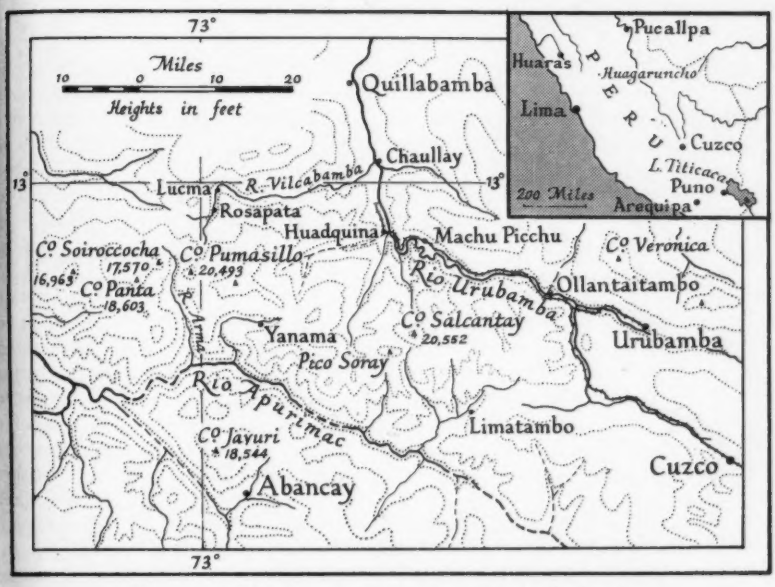
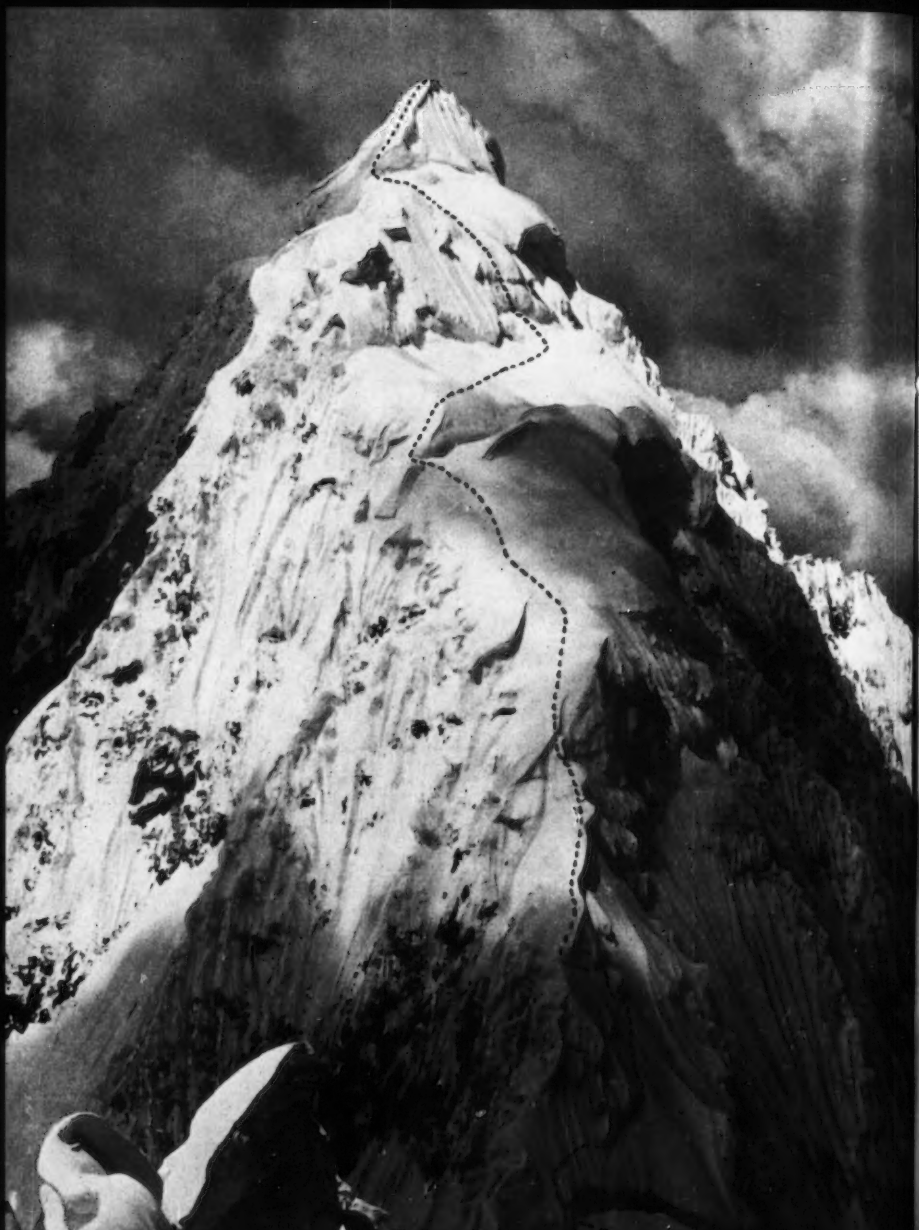


Figure 1. Sketch map of the Cordillera Vilcabamba

Figure 2. Sketch map showing the Cordillera Blanca, Huagaruncho and Pucallpa



Huagaruncho, from Peak 30 (17,856 feet): the route to the summit (18,797) feet

enabled them to reach camp before 11 p.m. after nearly five hours of climbing in darkness.

On August 17, Streetly and I were again in the lead. We started from the glacier camp before dawn, determined to make this the last time. We climbed strenuously and in silence up the route we knew so well, only a little hindered by the fresh snow in the tracks. We reached our previous highest point at 8.15. Thankfully we grasped the fixed rope left by Band, and climbed in the steps of the others to the top of the snow wall. We next had to tackle two pitches which I found the most exacting of the whole climb. The first was a section of snow softer and deeper than any we had yet met. For 10 feet I was up to my neck, scooping aside armfuls of snow and plunging forward into a trough whose sides collapsed as I moved; then it was chest-deep and hopes of the summit gradually returned; after 40 feet and forty-five minutes, I could walk again. The second pitch was a short and rather frightening climb round a corner onto the north face. Two or three inches of granular ice overlay soft snow at this point, and no single step seemed safe. However, the belay was near, the pitch was short, and the summit, at last, was in sight. We now arrived on the curving slope of the north-west side of the summit pyramid. We knew that there were cornices on the south side, so we cut steps up and leftwards to the ridge which came down from the top in a northerly direction. As the slope was concave, it gradually steepened, and the last 6 feet required hand-, as well as foot-holds. Plunging our ice-axes into the crest of the ridge, we arrived only 30 feet from the summit at 11.15 a.m. Knowing that the ice overhung to the south, first one and then the other advanced warily and on a taut rope as close to the highest point as he dared. Then we sat down, and ate, and hoped that the sky would clear. Clouds swirled around us and denied us a view during our stay, but we did not mind very much. It was enough that there were no more obstacles to avoid or climb. And now all we had to do was to get down again.

III. AWAY FROM THE MOUNTAINS

JOHN KEMPE

A new era of colonial exploration and development is beginning in Peru in the jungle to the east of the Andes. A road now leads across the Altiplano from Lima to Pucallpa—a dusty road and one which will be subjected to continuous improvement for a long time—but a road. Air strips are being laid and aeroplanes fly two or three times a week from Lima to the air strip at Pucallpa. Ships may reach the upper reaches of the Ucayali river by way of the Amazon. Agriculturists are busy clearing jungle areas and experimenting to find new methods of producing food. Colonists are arriving, and are about to push forward the fingers of civilization into those areas now inhabited only by Indian tribes, and as these fingers grasp the jungle so will the Indians find themselves subjected to the uncompromising squeeze of the civilized Latin American way of life for which they would normally be totally unprepared. Matthews and Tucker had been in Pucallpa and nearby Tournavista before the expedition to Huagaruncho. Their stories of crocodiles, pirhana fish, jiggers and hospitality had lost nothing in the telling and it was with the feeling that we were about to embark on some rare new adventure that Band, Westmacott and I decided to see Pucallpa for ourselves.

I first called on the Linguistic Institute in Lima. Domiciled on one of the

higher floors of a new Ministry building, its offices gave no hint of the life led by the headquarters staff at Pucallpa. The centres were in wireless communication when I arrived and the director said he would be delighted to have us to stay. Next day at 6 a.m. we were at the airport and ready to start. The Linguistic Institute was founded by an American named Townshend, now its first Director, to prepare the Indians for the initial adjustment which he foresaw they would have to make. The Institute made its headquarters in Latin America ten years ago at a spot 5 miles outside Pucallpa on the edge of lake Yarina Cocha and since then the population of the town has increased from a hundred to about ten thousand. The background of the Institute is to some extent a missionary one although many of its members are not ordained; and because the main objects are secular—not to evangelize but to educate—the Institute receives support from the Peruvian Government.

The Institute's headquarters at Pucallpa is a self-reliant international community, with about two hundred members. Although there is a waiting list its members have, for the most part, their own very comfortable houses built of wood, very often by themselves, the newest roofed with tin, the oldest covered in bougainvillea and other bright tropical creepers and all normally including refrigerators and wirelesses—but no television! Most members eat lunch and dinner in the communal mess and the children's educational needs are met, until the age of sixteen, in the community's school. With a simple but high standard of living go a host of technical inventions needed for the work of the centre. It is in wireless communication every day with Lima and its own outposts. It boasts an air strip just over 120 yards long hewn out of the forest, a seaplane base on the edge of the lake and the pilots, personnel, aeroplanes, seaplanes and hangar space to maintain a transport system. Here in the jungle technology, stripped of superfluous trappings, is evidently the handmaid of advance. There are three phases in the Institute's approach to a new tribe. First two men are taken by seaplane to a likely area and left with a canoe, provisions and an assignation to rendezvous a month later. During this time they are to make contact with a new tribe and find out whether a permanent visitor would be acceptable. In the second phase, if all goes well, two linguistic experts are sent to stay with the tribe for one or two years to learn the language. During this period they must decide from the study of the phonetics of the language how best to write it and how to compose the alphabet. We were told that there are some tribes to whom murder is no crime but who consider women of so little value that they will not trouble to kill them, and that in such cases it is often decided to send women to carry out investigations. In the third phase they return to Pucallpa, produce text-books and exercise books and take in, at the Peruvian Government's expense, a member of the tribe who is to be trained as a teacher and who will return for a short refresher course every year for six years. It is hoped that when civilization reaches these tribes they will be in the position of being able to read and write, and so better able to adjust themselves to changed conditions of life.

We touched down on Pucallpa air strip as the last dogs and pigs were being chased off and we were met by a member of the Institute, Ray Linke, in an open lorry. We had an hour to spend in the town while he shopped and we ambled round in the unaccustomed heat. We visited some sawmills from where some wood is transported (surely uneconomically) by lorry to Lima. We saw logs being floated down the Ucayali river to Brazil. Where it ends up and how it is paid for is hard to guess. Perhaps the rafts which we saw, with lightly thatched quarters, stalls for oxen, bins for food and enclosures for chickens supply the answer, begging the

question of how the owners return against the current. We watched the water-carrier delivering water at front doors, duly admired the tin roofs which are replacing thatch in order to cut down the risk of fire, and, climbing back into the lorry, raised clouds of suffocating dust out of the town and all the way down the jungle road to the Institute. We were shown to a delightfully furnished guest room, with sanitation, showers and running water next door, before being given an excellent lunch.

I think we should all have liked to lie down and rest after lunch. The heat was a change from Lima and the Altiplano and I, for one, felt overcome with drowsiness. However, a visit to the Shipibo tribe had been arranged for us and, in retrospect and during the visit if not before it, I would not have missed it for anything. We boarded a motorboat by the seaplane base, and Gene Smith steered for an hour along the lake, which curves like a horseshoe, until we reached the landing point for the village. If any of us had visions of cannibals who might pop us in boiling oil those visions were soon dispelled by the laughing children who greeted us and who demanded a marble each from the bag which Gene swung ostentatiously by his side. This is the only Shipibo village in constant touch with civilization. The villagers themselves seemed very little disturbed and to accept peaceably the blessings which the people of Pucallpa bring them.

We walked from the landing stage for about 200 yards along a path through jungle and clearings sown with Indian corn until we reached some houses strung out haphazardly along a narrow clearing. The roofs are thatched but there are no walls, and a family of twenty may live under one roof, cooking and eating and sleeping on one floor space of hard, flattened earth. We saw no men in the village—all were fishing or engaged in agriculture—so we watched the women, surrounded by their children and grandchildren, making bowls, spinning and weaving, drying fish and cooking. Although it has been declared illegal by the Peruvian Government the villagers still, like the Incas of old, distort the heads of their children. Bamboos are placed across their foreheads and bound there until they are a year old and their heads sufficiently distorted to be considered beautiful. We visited the school, a wooden building with walls, where the three R's are taught and where the children seem to accept education in the same spirit as other children. One could only guess at the prodigious effort which someone must once have made to bring this about. After returning to the Institute we left next day, Westmacott in a light aeroplane and Band and I in an Oranca seaplane, for Tournavista. The seaplane—a two-seater—had, probably not for the first time, to carry three. As we sped across the lake up wind no effort on my part of rocking from the rear luggage compartment would induce the plane to leave the water. We turned back disconsolately to try our luck down wind. When we had already crossed most of the lake we hit one of our own ripples and became adventitiously airborne and so able to make the visit. The only landmarks on the 70-mile cross jungle journey are the Ucayali river and the slight rise which marks the site of the new Ganz Azul oil fields; otherwise millions of square miles of jungle are featureless.

Four years ago a ship sailed up the Amazon and Ucayali rivers carrying giant caravans, jungle-clearing equipment and all that was thought necessary to found a centre for colonial development. About 100 miles upstream from Pucallpa a convenient bank was found on which to land cargo. So started Tournavista—named after its founder, Le Tourneau, an American, who sold his share of the business in Caterpillar tractors to Westinghouse and concentrated his energies on clearing the jungle and growing more food. In return for building 54 kilometres of road from the landing point half-way to Pucallpa, he obtained a large land concession from

the Peruvian Government and the right to sell plots to colonists. We first visited the new sawmill which will provide wood for houses. At present the population lives for the most part in giant trailers—trailers which are far too big to travel along most English roads and which house two families comfortably. They are equipped, as in Pucallpa, with refrigerators, showers, running water and everything required to make life comfortable. We fed in the mess in one and slept in a men's dormitory in another. In the afternoon we looked round the 35-acre experimental farm on whose outcome the success of the whole venture will ultimately depend. The land is short of minerals. Once cleared it will produce crops for two years without treatment but, unless special treatment is given, reversion to jungle is necessary before further food crops can be grown. The technical problems, explained with great lucidity by an expert, escape the memory of an amateur who remembers how surprising it was to see cabbages, lettuces and tomatoes growing in such heat. And how stunted, considering that Peru is its home, is the potato!

Before visiting the farm Jim Le Tourneau had taken us to see the jungle roller. This modern version of a prehistoric monster weighs 110 tons. Its two front and two rear rollers, each with protruding steel teeth, are driven from inside by electrically powered independent motors each operated by a press-button from a central cabin. As the giant roller moves forward under tremendous power, it knocks over, then flattens, then crushes everything in its way. The shallow-rooted jungle growth gives way easily and is burned after it has dried in the sun. So is cleared in a few days an area which it would have taken man months to clear by his own efforts. But the roller has its own problems. The jungle was first surveyed from the air and was wrongly thought to be flat: it undulates, and the roller which sometimes has to go uphill is as handicapped by its own weight as its living antediluvian predecessors were by theirs. If ever a Mark II is born to deal with the jungle of the montana it will have to suffer a mutation.

Next day we were to be taken in a 10-ton lorry to the extremity of the road which Le Tourneau agreed to build and which is now almost finished; then, after walking the 5 miles which is all that separates it from the road which thrusts out from Pucallpa to meet it, we were to travel back by taxi. After breakfast at 5.30 a.m. we clambered onto the lorry which carries out the road builders every morning. The surface of the road is earth, it had rained, and I was soon aware that wet mud is to the wheels of a 10-ton lorry as ice is to the wheels of a car. The road twists and turns and undulates, at times steeply. The lorry could do 65 m.p.h. and it did 65 m.p.h., not on occasions, but with unrelenting determination while, in order to absorb the skids, the driver rolled the steering wheel to left and to right, with careless abandon. Vain is the help of logic which impels one to concede that if a driver has done this for two years he is unlikely to overturn today. Macaws, toucans and ants' nests suspended high in the trees were pointed out to me to divert my attention, but Gene Smith said he had never seen anyone look so frightened and inattentive. I arrived feeling like a wet rag; waiting there was a pride (I think this is the right word) of new machines to be examined—diggers, levellers and the giant tree stinger. For it appears that the jungle roller may, on occasions, meet its match and then the stinger comes into play. It runs up to a tree, lazily puts out its long giraffe-like neck, checks for a second, heaves, and then its prey, after a second of tottering hesitation, goes crashing to the ground. It is all too easy. If one had only been allowed to see it once one would have said "Please do it again." This was unnecessary. The stinger knocks over about sixty trees in an hour, darting here and there and knocking trees down indiscriminately in various directions, careful only

John Kempe on the south face of Huagaruncho

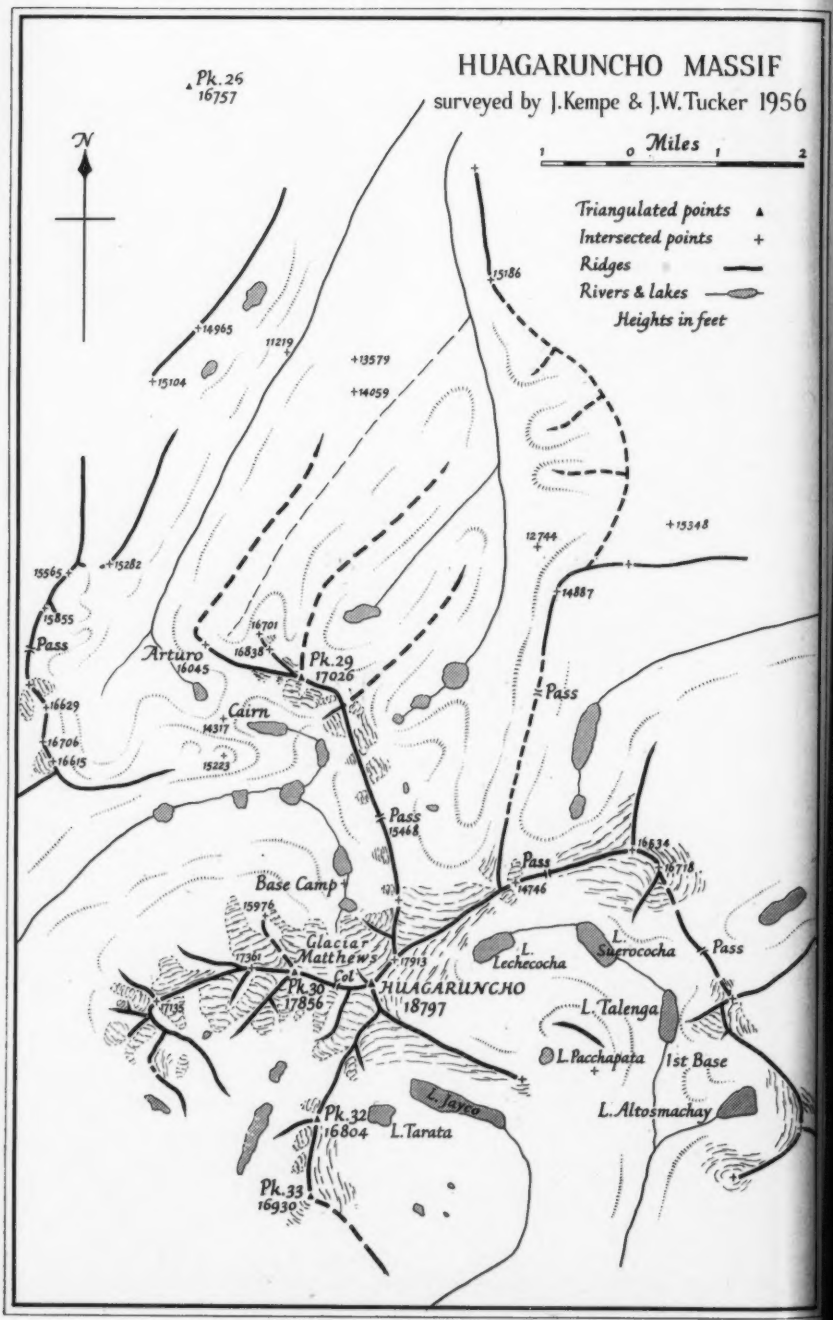

HUAGARUNCHO MASSIF
surveyed by J.Kempe & J.W.Tucker 1956
Miles
1 0 1 2
Triangulated points
Intersected points
Ridges
Rivers & lakes
Heights in feet
N
Pk.26
16757
+14965
11219
+15104
+13579
+14059
15186
+15348
12744
14887
15565
+15282
15855
Pass
16629
16706
16615
Arturo
16045
16701
16838
Pk.29
17026
Cairn
14317
15223
Pass
15468
Pass
14746
16834
16718
Base Camp
15976
Glaciar
Matthews
17361
Col
17913
Pk.30
17856
HUAGARUNCHO
18797
17135
L.
Lechecocha
L.
Suerococha
Pass
L. Talenga
L. Pacchapata
1st Base
L. Jayea
L. Altosmachay
Pk.32
16804
L. Tarata
Pk.33
16930

Figure 3

to leave itself a way out from among the carnage of bodies. And so back to Pucallpa and to Lima. One would have liked a month in the area. This is undoubtedly a land of promise and it had been a wonderful experience to see, even for so short a while, the work which is being done.

It was a great shock to all of us when, after we had returned to Lima, the British Consul rang up one morning to say that he had just had word that Don Matthews had died of heart failure during the night. He had been fit and very much alive the evening before and had been in good form throughout the expedition. Don will be remembered by all who knew him as an excellent doctor: as a tremendous enthusiast for exploration: as a first-class raconteur: and as a New Zealander with a happy way of making friends and of keeping them.

A letter received earlier this year from the Grupo Andinista Cordillera Blanca pays this tribute: "We have named the series of glaciers to the north of the Nev. Huagaruncho 'Glaciar Matthews' in order to honour posthumously the distinguished British mountaineer, whose name will thus remain linked with the Peruvian Andes and our geographical maps. On maps which the Royal Geographical Society of London may make of this region, this name should please be given to these glaciers of the Huagaruncho system. This decision has been taken by Peruvian 'andinistas' (mountaineers in the Andes), in special consideration of the important expedition under your direction."

DISCUSSION

Evening Meeting, 8 *April* 1957

Before the paper the PRESIDENT (General Sir JAMES MARSHALL-CORNWALL) said: Huagaruncho is one of the higher peaks of the Central Andes of Peru. Our Society has a close and cordial association with Peru, an association going back to the days of Sir Clements Markham, one of my more eminent predecessors who established an all-time record in serving as President of the Royal Geographical Society for twelve consecutive years. That record will not be beaten.

Markham was a remarkable man. He first visited Peru in the year 1845, more than one hundred years ago, as a midshipman in the Royal Navy. He fell in love with Peru at first sight, so much so that he left the Navy a few years later and devoted a great part of his life to travelling in Peru and writing on its history and geography. After his death the Peruvian Government expressed their appreciation of Sir Clements Markham's services to their country by presenting to the Royal Geographical Society the bust of Sir Clements which now stands outside the Society's front door facing Kensington Gardens.

The Society's association with Peru is still being maintained. Since 1939 Dr. J. V. Harrison, lecturer in geology at Oxford, has carried out six expeditions to Peru for the purpose of geological survey and topographical mapping. The result of those six expeditions is a map covering 7000 square miles of Peruvian territory which has been compiled in the Society's drawing office and published in the March 1957 number of the *Geographical Journal*. At the close of this meeting I will have great pleasure in presenting a copy of that map, with Dr. Harrison's accompanying report, to H.E. the Peruvian Ambassador, who, with Madame Rivera Schreiber, has done us the honour of being present this evening. On your behalf I bid them both a cordial welcome.

And that brings me back to the Nevado de Huagaruncho. Huagaruncho is no mean mountain. Its height is 5748 metres or nearly 19,000 feet. It was climbed for the first time in the summer of 1956 by a British expedition led by John Kempe who carried out in 1954 that great reconnaissance of Kangchenjunga which blazed the

trail for the successful expedition under Charles Evans, which in 1955 climbed Kangchenjunga for the first time. John Kempe was accompanied by George Band and Michael Westmacott who need no introduction to this Society, having both been members of John Hunt's successful 1953 Everest Expedition. John Kempe, George Band and Michael Westmacott will now tell us how they conquered Huagaruncho.

John Kempe, George Band and Michael Westmacott then read their papers

The PRESIDENT: I wish my great predecessor, Sir Clements Markham, could have been present this evening. He would have had nostalgic memories of that country with which he fell in love at the age of fifteen, a susceptible midshipman, in the month of January 1845. I will not say anything with regard to the magnificent effort this expedition made to get to the top of that really very difficult mountain, but these hard-bitten Himalayan mountaineers tell me that the climbing of these Peruvian mountains is just as difficult, if not more so, than climbing the Himalayan giants they have all tackled, apart from the fact that they do not need to burden themselves with oxygen owing to the slightly lower altitude.

As I have said, we have with us this evening a very great friend of our country in H.E. Señor Dr. Don Ricardo Rivera Schreiber, the Peruvian Ambassador, and I would like now, on your behalf, to present him with the number of the *Geographical Journal* which contains Dr. Harrison's map of the Central Andes of Peru and the report accompanying it. I would ask His Excellency to add a few words.

H.E. SEÑOR DR. DON RICARDO RIVERA SCHREIBER (Peruvian Ambassador) then said: Mr. President, Ladies and Gentlemen, We are very proud of our Inca remains and the jungle and pleased to welcome expeditions and geographical delegations into our country. We are always grateful to them for coming and will always be pleased to give them all possible facilities and hospitality because we feel such visits are to our mutual benefit. In July 1957 two delegations from Cambridge University are going to the same region because there are three or four more Inca cities still covered by the forest. Such expeditions render a great service to Peru and to the world in general. I repeat that we are very happy to welcome these expeditions to Peru, especially when they are patronized and recommended by the Royal Geographical Society. Mr. President, you have been kind enough to remind me of the long-standing ties between Peru and the Royal Geographical Society. It is true to say that to nobody could Peru be more grateful than it was to Sir Clements Markham while he lived, and grateful to his memory for ever. Sir Clements travelled all through Peru. He went there five or six times; he wrote about eighteen books on Peru and entered into the political life of the country. I thank you, General, for presenting to me the *Journal* of the Society with this most useful map which I will send to my Government. I thank you also for inviting me to be here this evening.

MARINE SURVEYING IN BRITAIN DURING THE SEVENTEENTH AND EIGHTEENTH CENTURIES

A. H. W. ROBINSON

THE EARLY MEETINGS of the Royal Society, following the granting of its charter in 1662, were notable for the many diverse subjects which came up for discussion, particularly those connected with experimental science and the perfecting of instruments. The appointment of Robert Hooke as "Curator of Experiments" in November of that year had a most stimulating effect on the practical activity of the Society, each meeting being characterized by a number of demonstrations using apparatus or instruments designed by Hooke himself. One of the many fields of enquiry which engaged the indefatigable Hooke's attention in his newly created office was that of furthering existing knowledge of the form and characteristics of the sea bed. To this end he exhibited before members an instrument which he had made to sound ocean depths. His idea was to replace the ordinary lead line with a sounding ball apparatus and this he claimed would lead to a considerable saving of time, especially in deep oceans.[1] When it was tested at the mouth of the Thames, it was "found to do exceedingly well" but as this was a phrase often used by Hooke in connection with the performance of his instruments, little significance can be attached to it, especially as he subsequently designed a number of such instruments to carry out the same task. But at least it was a beginning and indicated a readiness on the part of Hooke and his associates to tackle a problem that had been shelved for too long.

While Hooke was busy developing his various instruments, two members were investigating some of the more theoretical aspects of marine surveying, in particular position-fixing at sea. In a paper read before the Society in 1674, John Collins provided a mathematical solution to what is now known as the resection, or three-point, problem.[2] Collins, who had had some experience at sea in his youth, was not slow to realize the practical implications of his mathematical exercise, and in the introductory paragraph of his tract he claimed that "the problem may be of good use for the due situation of sands and rocks that are within sight of land marks whose distances are well known." Much the same argument was used by John Caswell, Vice-Principal of Hart Hall and an active member of the Oxford Philosophical Society, when addressing members of the Royal Society in 1685.[3] Caswell, it will be recalled, had some practical experience of land surveying for he was associated with John Adams in the latter's unsuccessful project for a trigonometrical survey of England and Wales in the years 1681 to 1684, during the course of which he had determined the heights of various hills in Wales and the Border country with a remarkable degree of accuracy.[4]

As far as marine surveying was concerned, however, theory was far in advance of practice. Admirable though the mathematical solutions of Collins and Caswell were, real progress could not be expected until an instrument was developed for taking angles at sea. It is true that Hooke, as early as June 1665, had this in mind when he produced a simple type of quadrant. By August of that year he was able to write to his friend Boyle that "one of our quadrants does to admiration for taking angles, so that thereby we are able from hence to tell the true distance between St. Pauls and any other church or spire in the City that is here visible, with the quality of 12′ which is more than is possible with the more accurate instruments

or the most exact way of measuring distances." [5] Further progress seems to have been made by 1669 when Hooke showed members of the Royal Society an instrument for taking angles based on the reflecting principle. In the following year when a telescope was added to the sighting arm, members were sufficiently impressed to ask him to produce an instrument of this type for testing at sea. It is not known whether Hooke ever complied with the wishes of members, but it is perhaps significant that many years later, in 1681, when questioned about a reflecting quadrant, he was evasive and intimated that his instrument was not quite finished. By this time the great drive and resourcefulness which had characterized his work in the early years of the Society was beginning to lose much of its tempo, possibly as a result of disagreements, first with Oldenburg, the editor of the Philosophical Transactions, and later Newton. Whatever the outcome of Hooke's attempts at constructing a satisfactory reflecting quadrant for use at sea, it is clear that neither the navigator nor the marine surveyor benefited directly from his labours.

The awakening of interest in marine surveying during the latter half of the seventeenth century was in some respects a result of the favourable scientific climate of the period when embryonic ideas were nurtured and developed. In part, however, it was the direct expression of a practical need, that of providing a set of accurate charts covering the shallow coastal waters around the British Isles. If this could be done by using domestic resources, the English seaman would at last be independent of Dutch charts or the anglicized versions of the same. As is well known, John Seller, the hydrographer and publisher, used refurbished Dutch copper plates destined for scrap in the preparation of his 'English Pilot,' published in 1671. Only one chart, that of the approaches to the Thames, represented a new compilation, having been prepared from a survey by Jonas Moore and two Trinity House pilots and even this was included, as Moore complained afterwards, without his permission. The methods used by Moore and his associates were those of a sketch survey, soundings being taken in the main navigational channels and the limits of the adjacent banks being roughly delineated by eye. It is little wonder that the chart was not greatly superior to those prepared almost a hundred years earlier by the Elizabethan cartographers, Robert Norman (1580) and William Borough (1596).[6] This fact, coupled with the deficiencies of the "second-hand" charts in the 'English Pilot,' quickly brought Seller's marine atlas into disrepute and undoubtedly strengthened the hand of those who advocated an entirely new survey of the British shores. This task ultimately came the way of the young naval captain, Greenvile Collins, in 1681.

New light on this first real attempt at a complete marine survey of home waters has recently been forthcoming from information contained in Admiralty Orders, now preserved in the National Maritime Museum.[7] It is clear that although Collins received encouragement from the King, Trinity House and the Admiralty, and was ultimately paid almost £2000 for the survey, the project suffered from lack of money from the start and probably was never carried out with the thoroughness originally envisaged. Without adequate land maps, especially on a sufficiently large scale, Collins had to spend a disproportionate amount of time on a preliminary land survey, fixing prominent objects and delineating the coastline. We are told by John Evelyn, in an entry in his diary dated February 1683, that on a visit to the Court at St. James he saw the results of two summers' work by Collins who by this time had "taken all the coastings from the mouth of the Thames as far as Wells and exactly measuring every Creeke, Island, Rock, Soundings, Harbours, Sand, Tide and intending next spring to proceede til he had finished the whole Island: and that measured by Chaine and other instruments, a most useful and exact under-

taking." [8] When one considers the magnitude of Collins' task, the meagre resources at his disposal, the lack of large-scale maps of the land area adjacent to the coast, the relatively crude instruments then in use and, more important, the absence of an adequate survey technique, one can only marvel that he accomplished as much as he did during the seven years spent on the survey.

Contemporary critics did not share such a view. The publication of Collins' charts as 'Great Britains Coasting Pilot' in 1693 unleashed a flood of criticism from many quarters. Trinity House, who had shown a mild interest in the project and had made Collins a Younger Brother at the outset, complained of "the Ill Performance of the Book of Carts." Pepys, too, was a little disappointed especially when he found that the Dutch cartographers had preferred to copy Jaillot's 'Neptune Francois' rather than Collins for their charts of the British waters.[9] Robert Hooke, who, despite his interest in marine survey, was not consulted when the project was being formulated and doubtless felt a little piqued, also joined in the attack although refraining from mentioning Collins by name.[10] In a discourse on measuring heights and distances at sea in 1694, he suggests a better method of survey "which if the gentleman that described the coasts of England had known or put into practice, I conceive, he would have prevented many mistakes he has therein committed." Hooke realized that any method which relied on the compass for measuring angles, as Collins had done, was likely to be imperfect; his "better" method, therefore, consisted of using a quadrant for this part of the operation. The angle observations were to be made simultaneously from the bow and stern of the vessel and by using the ship's length as a base, a fix made of prominent objects on shore by intersection. In this way the coastline and land detail of likely interest to the navigator could be drawn in at the same time as the vessel was sounding offshore. The limitations of Hooke's method, with its very short base-line, are obvious and would quickly have become apparent in use. Perhaps it was as well for Hooke's reputation that it was never followed up.

Another Fellow of the Royal Society who gave serious thought to the perfecting of an accurate method of marine survey was no less a figure than Edmond Halley. As early as 1689, as a young man of thirty-three, he produced a draught of the entrance to the River Thames which he claimed was superior to existing charts of the area. This was followed in 1693 by a survey of part of the Sussex coast between Selsey and Arundall (*sic*) "with the true form and situation of the dangerous shoal called the Owers." Following his successful cruise in the *Paramour* and with his earlier experience of charting behind him, he wrote to Sir Robert Southwell in 1701 suggesting a method of marine survey independent of the magnetic compass which he did not favour "because of the smallness of the radius of the Magneticall Chart and the uncertainty of the variation on the land, the needle being affected with the neighbourhood of Iron Oar and Mineralls." [11] Halley's proposed method is interesting in that the theory of resection, demonstrated mathematically by John Collins in 1674, was shown to be capable of practical application in marine surveying. After a preliminary land survey to "fix remarkable objects such as Steeples, Mills, Rocks, Cliffs, Promontories and like as you find conspicuous along the coast," the surveyor is instructed to measure the included angles between these land objects from his vessel anchored offshore. The values obtained could then be used to solve the resection problem geometrically with a pair of intersecting circles. In the same way the position of the ends of shoals, dangerous rocks, etc., could be found accurately. From a theoretical standpoint, Halley's method is quite sound and is in fact used in marine survey at the present time: the use of the geometrical method to solve the three-point problem, however, would be very laborious in

practice and probably would have to be limited to fixing a few fundamental positions at sea accurately. The plotting of a close sounding cover, a prime necessity if charts were to become more accurate and reliable, was still not possible. Nevertheless, the method was superior to any then in use and might well have become adopted universally but for the inopportune time when it was put forward.

The early years of the eighteenth century saw a considerable change in scientific thinking and practice compared with the fruitful period following the Restoration. After Hooke's death in 1703, the Royal Society became more and more influenced by Newton with the result that the abstract sciences came to the fore and a general narrowing of the field of primary interest took place. Even Edmond Halley, a prominent member of the Society, seems to have forsaken hydrography, although as one of the Commissioners of the Board of Longitude, he retained some interest in navigational matters. The Admiralty, too, showed little concern and although in 1698 they were instrumental in having a series of harbour surveys made along the south coast of England, this was in connection with possible sites for dockyards and not part of a general scheme of coastal survey. With this lack of interest both in official quarters and in the premier scientific society, the field was left open for amateurs whose enthusiasm often far outweighed their ability to bring their schemes to fruition. Lack of resources often meant that ideas, especially those involving the development of new instruments, progressed no further than the drawing board.

Henry de Saumarez, the inventor of an instrument called the "Marine Surveyor" and the author of a manuscript chart of the Channel Islands, was more persistent than most; his experience in the early part of the eighteenth century is illustrative of the declining interest and lack of progress at this time. The "Marine Surveyor" consisted of a four-vaned paddle which revolved when towed behind the vessel, the number of revolutions being recorded on a dial (Fig. 1). After calibration over known distances, the dial would give an accurate measure of the distance sailed, at least this is what Saumarez hoped. In 1715 while the instrument was still only at the drawing stage, he sought the help of the President of the Royal Society, Sir Isaac Newton. When nothing came of this approach, he petitioned the King who in turn passed it to the Admiralty. Before coming to a decision the Lords Commissioners consulted Newton, who by this time had decided that "as he had no experience of sea affairs, he was not in a position to judge." Trinity House were then approached but after spending a considerable time experimenting with a wooden model of the instrument, they, too, reported unfavourably. Saumarez then made an actual machine which he tested on a canal in St. James's Park in 1723. As late as 1728 he was still experimenting, having replaced the four-vaned paddle by a Y-shaped "Fork" in the intervening period. In a paper read before the Royal Society in 1729, he described the trials he had conducted with the modified machine, trials which included a voyage to Holland. It was clear from his account, however, that all was not well with the machine and the accurate measurement of distance at sea still eluded him.

Although the name "Marine Surveyor" was used for the machine and Saumarez, as we have seen, did make a chart of the Channel Islands, it is unlikely that he used his measuring device while engaged on marine surveying. We know from his own statements that the greater part of the Channel Islands survey was undertaken prior to 1715 when the "Marine Surveyor" was still on the drawing board. It seems, therefore, that although an inset of the machine was included on the chart when it was issued in 1727, this may well have been for the purpose of advertisement. It is conceivable that Saumarez wished the interested authorities to associate the two

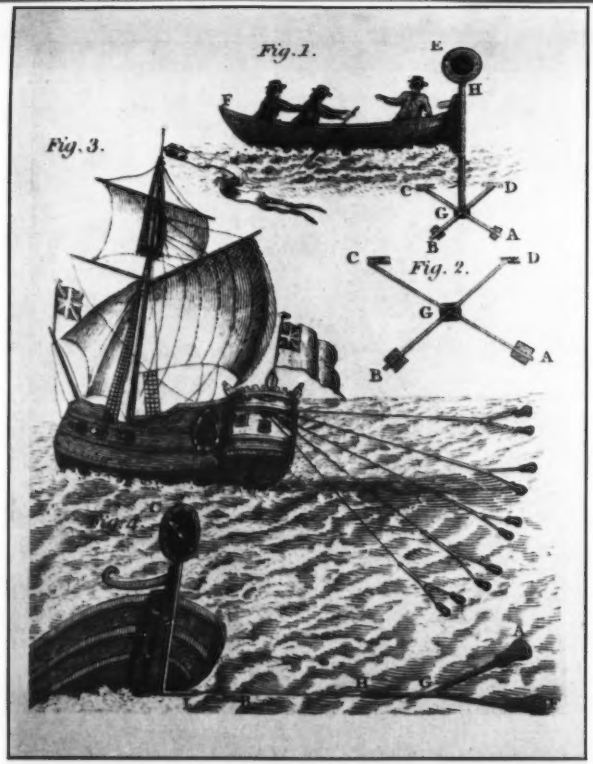


Fig. 1. The "Marine Surveyor" of Henry de Saumarez (reproduced from Phil. Trans. **7** *(1724–34) Plate VIII)*

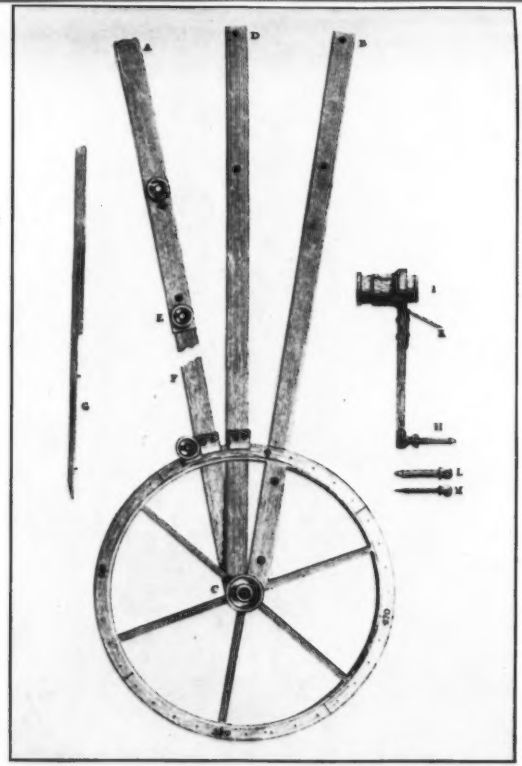
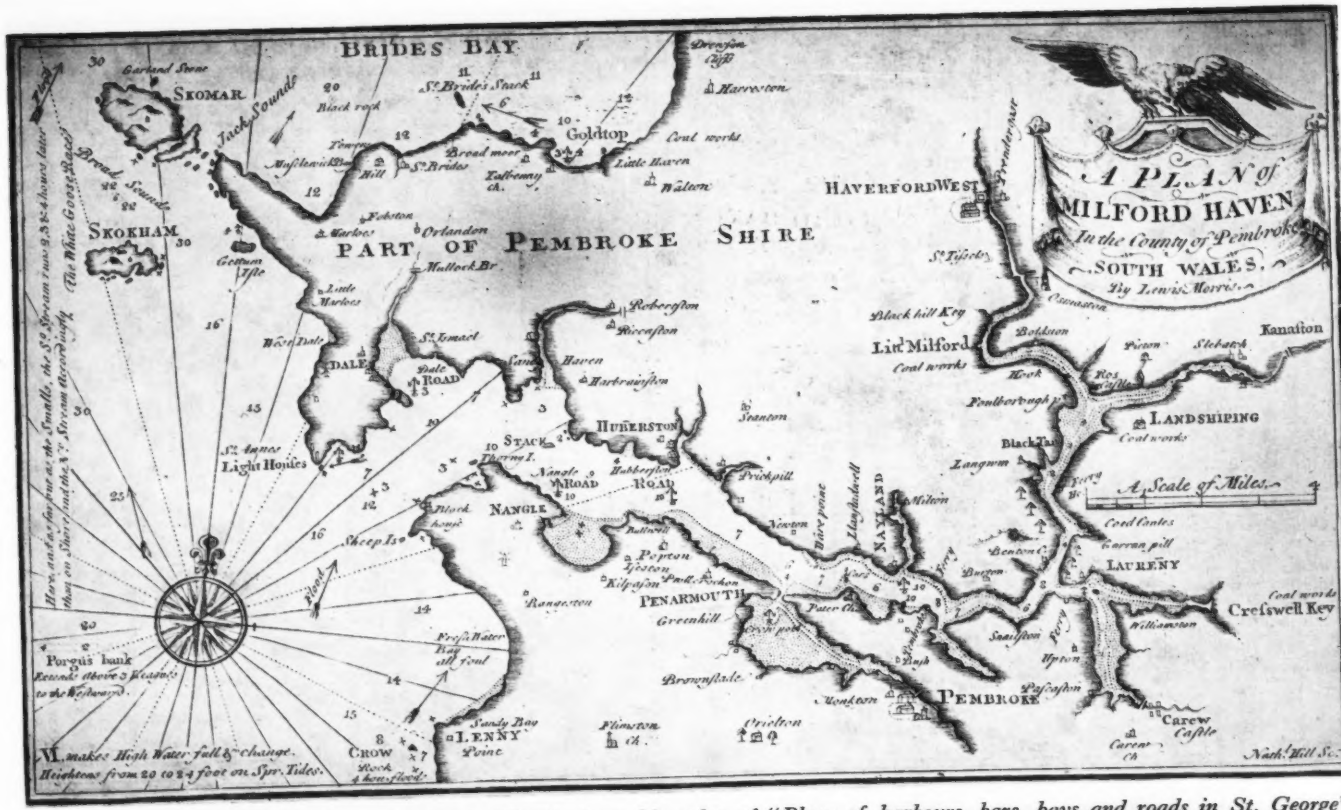


Fig 4. Early form of "Station Pointer" for hydrographic surveying


BRIDES BAY
SKOMAR
SKOKHAM
Garland Stone
Tack Sounds
Broad Sounds
St Brides Stack
Black rock
Goldtop
Coal works
Broad moor
St Brides
Little Haven
Walton
Harroston
Dreeston Cliff
HAVERFORDWEST
PART OF PEMBROKE SHIRE
Orlandon
Haroldston
Hasguard
Hill
Talbeny ch.
Gesteum Isle
Mallock Br
Little Marlows
Robeston
Riccaston
DALE
Dale ROAD
Haven
Harbrainston
HUBERSTON
Stanton
STACK
Thorny I.
Nangle ROAD
Hubberston ROAD
NANGLE
Sheep Is
Pickpill
Hazelbeach
NAYLAND
Milton
Newton
Blue pool
Popton
Kilpaison
Pwll Rochon
PENARMOUTH
Rangerton
Greenhill
Frost Water Bay all foul
Sandy Bay
I. LENNY
Point
Flimston ch.
Orielton
Brownslade
Monkton
PEMBROKE
Paskeston
Hyton
Carew Castle
Carew ch.
Nath. Hill Sc.
Porgus bank
Uncovds above 3 fathoms to the Westward
VI makes High Water full & ye change.
Heighteens from 20 to 24 foot on Spr. Tides.
A PLAN of MILFORD HAVEN
In the County of Pembroke
SOUTH WALES.
By Lewis Morris
Castlemartin
Black hill Key
Lit. Milford
Coal works
Boldston
Pwlcorn
Stebarch
Kanaston
Hook
Pembrough
LANDSHIPING
Coal works
Black Tar
Langwm
A Scale of Miles
Cood Cantes
Carean pill
Benton
LAUREN
Creswell Key
Coal works
Williamston
Snailston
Ferry
Upton
Castle
Ferry
Burton
Pater
Pater Ch
Pwll Pool
Pwll Pool
Rosemarket
Rosemarket Ch
Prendergast
St Issells
Castlemartin
Angle
Angle Bay
Pwllcrochan
Pwllcrochan Ch
Lawrenny
Cresswell Quay
Cresswell Quay Ch
Lamphey
Lamphey Ch
Hodgeston
Hodgeston Ch
Penally
Penally Ch
Manorbier
Manorbier Ch
Manorbier Castle
Jameston
Tenby
Tenby Ch
Tenby Harbour
Giltar Point
Caldy Island
Caldy Ch
Caldy Priory
Monkstone Point
Monkstone Ch
Saundersfoot
Saundersfoot Harbour
Wiseman's Bridge
Amroth
Amroth Ch
Begelly
Begelly Ch
Kilgetty
Kilgetty Ch
Stepaside
Stepaside Ch
Templeton
Templeton Ch
Narberth
Narberth Ch
Robeston Wathen
Robeston Wathen Ch
Crunwear
Crunwear Ch
Canaston Bridge
Canaston Bridge Ch
Llawhaden
Llawhaden Ch
Lampeter Velfrey
Lampeter Velfrey Ch
Llanddewi Velfrey
Llanddewi Velfrey Ch
Llanddewi Velfrey Castle
Llanddewi Velfrey Castle Ch
Llanddewi Velfrey Castle Ch
Llanddewi Velfrey Castle Ch

and this would partly explain the odd name which he gave to what was an early form of patent log. In spite of the persistent efforts of Saumarez, his instrument was not destined to become the key to surveying at sea for it was the measurement of angles and not distances which was ultimately to provide the solution.

The development of an instrument for taking angles at sea did, as we have seen, exercise Hooke's attention for some time. Later Newton made a similar, although more advanced, instrument based on the reflecting principle, but as the details of this were not published until after Halley's death in 1742, Newton's contribution had no practical significance. In the meantime, John Hadley had perfected a reflecting octant which he showed to members of the Royal Society in 1731.[12] A second instrument with a number of refinements was made and this was tested in the following year before representatives of the Admiralty on board the *Chatham* yacht, anchored off Sheerness. Although Hadley's octant quickly found favour for measuring vertical angles in connection with latitude observations, its value in marine surveying was completely overlooked. As late as 1765 a member of the Royal Society complained of its neglect for this purpose. In the intervening period, extensive hydrographic surveys such as those of Lewis Morris in Wales and the elder Mackenzie in Scotland were undertaken, using old methods based on compass intersection for fixing the position of soundings.

The career of Lewis Morris affords a further example of the frustration likely to be encountered by any would-be private hydrographic surveyor during the first half of the eighteenth century. As a young man in his twenties, Morris was employed in making a survey of Bodorgan estate in Anglesey between 1724 and 1727.[13] Two years later he was appointed waiter and searcher of His Majesty's Customs at Holyhead and it was while he was in their service that he realized the imperfections of existing charts not only of the coast of Anglesey but also of the whole of Wales. He put forward a scheme to the Commissioners of the Customs, but although his employers were sympathetic they could not proceed without Treasury consent.[14] When this was not forthcoming, Lewis Morris resolved to approach both the Admiralty and Treasury direct and this he did in October 1736. He suggested that either the Admiralty should lend him a sloop of 20 tons, or that the Commissioners of the Customs should be allowed to use one of their vessels for surveying under his direction. After much delay he obtained neither, and although he was allowed to keep his Custom Office salary of £20 a year, the expenses of hiring a boat and hands were to be met out of a paltry grant of only five shillings a day. Reluctantly Morris agreed to these conditions in order, as he put it, "that I might show their Lordships a specimen of my work, tho' too scanty to bear my expenses, as I told them." According to Morris, the Board "promised better encouragement if they liked what I did."

The survey was begun in July 1737, near the Great Orme Head and by October, when bad weather put an end to surveying, Morris had progressed as far as Anglesey. He then returned to his desk in the Customs Office in Holyhead where he spent a good deal of the winter digesting his observations and making preliminary draughts of his charts. Some of these were then forwarded to the Admiralty with a reminder of their promise to look favourably upon his project but again he was unsuccessful in obtaining the use of a vessel on Navy account. In the next season, therefore, he was forced to spend most of his time on land surveying, building up a coastal triangulation network and sketching in details of the topography. Having reached as far south as Strumble Head by October 1738, he again petitioned the Lords Commissioners for a vessel "to take ye Sounding, setting of Tides and Prospects of ye Coast" and thus complete his imperfect draught. He was no more

Fig. 2. Survey of Milford Haven by Lewis Morris, from his atlas of "Plans of harbours, bars, bays and roads in St. George's Channel," 1748

successful on this occasion than before. Worse was to follow in that the Custom Commissioners decided in May 1739 that he was to have no further leave of absence, thus forcing him, at least temporarily, to abandon the half-completed project. There the matter rested until 1742 when, after representations to the Board of Admiralty by Owen Meyrick, the owner of the Bodorgan estate that Morris had surveyed many years previously, the survey was resumed. In June of that year Morris was out on the Sarn Badrig off the Merioneth coast. From now on the survey proceeded more smoothly and it is noticeable that the charts of the coast of south-west Wales were superior to those of the earlier period (Fig. 2). By 1744 when the war with France brought the survey to an end, Morris had surveyed the whole coast from the Great Orme Head round to St. Govans Head in Pembrokeshire in addition to which he prepared many larger scale draughts of harbours and anchorages. Both his general chart of the coast of Wales and his collection of harbour plans were then forwarded to the Admiralty who decided that they should be published and made available to all interested (Fig. 3). As was the customary practice at that time, the engraving and printing was left in Morris' hands and to this end he engaged his fellow countryman and well-known copper engraver, Emmanuel Bowen, to prepare the charts. Great interest was aroused in shipping circles by this first attempt of an extensive survey of the coast of Wales and by the time publication began in 1748, well over a thousand copies had been ordered. The subsequent demand was also great, both for the atlas of harbour plans and the general chart and by 1761 the issue was sold out. As late as 1801 a new edition of the atlas and the general chart was prepared by his son, William Morris, and issued in Shrewsbury.

While Lewis Morris was engaged on the final stages prior to issuing his charts of the Welsh coast, another amateur hydrographer, Murdoch Mackenzie (Senior), had begun a survey of the Orkney Isles. It is known that the survey was largely at his own expense although the Navy Board did loan him a theodolite, plane-table and chain in 1744, presumably at the outset of the survey. When completed, the charting of the Orkneys attracted sufficient attention in official quarters for Mackenzie to be asked by the Lords Commissioners to continue his surveys along the west coast of Scotland and include the Outer and Inner Hebrides during the course of this work, this time with official assistance. The methods of survey used by Mackenzie, involving the establishment of an extensive triangulation network across the Minch, have been discussed elsewhere.[15] With so much attention given to land survey there was an inevitable reduction in the time allowed at sea with the result that the number of soundings inserted was not great. In an area such as that off the west coast of Scotland, a general indication of depth such as Mackenzie provided was permissible, although there was always the danger that isolated pin-head shoals would be missed. In the shallower waters of the North Sea bays and estuaries, however, the single sounding traverse based on compass fixes was quite inadequate and could be both misleading and dangerous.

For areas such as this, the Reverend John Michell, in a paper read before the Royal Society in February 1765, suggested an alternative method of fixing which he claimed was more accurate.[16] Using a Hadley quadrant, angle observations were to be made from a vessel on two or three pairs of objects previously fixed on land. Michell was at a loss to solve the resulting resection problem so he suggested that "it will be better still to have two observers, one in a boat and the other on land," at the other end of the base line, and together they take simultaneous angle readings at the instant of a pre-arranged signal. The angle measurements were then used to solve the triangle formed by the boat and the two stations on shore. Further con-

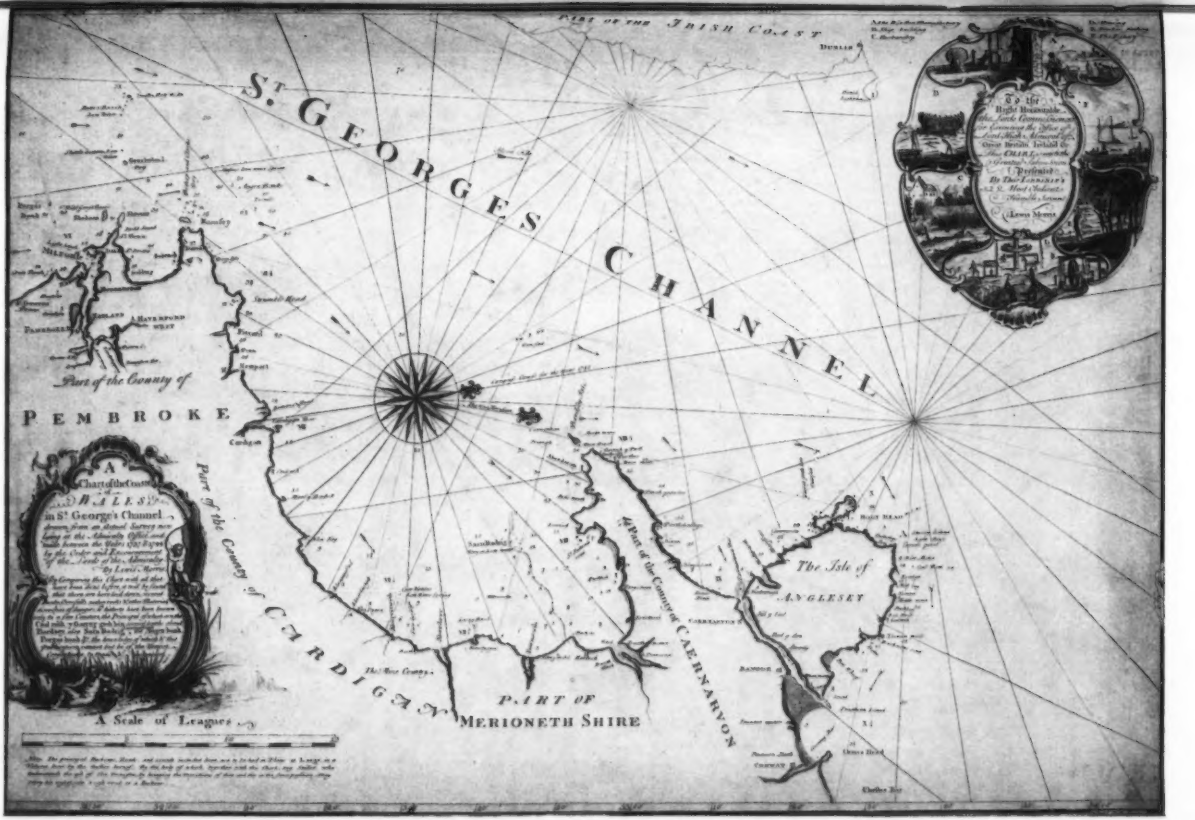


Fig. 3. Chart of Welsh coast, by Lewis Morris, 1748

Fig. 5. Part of Lieut. Murdoch Mackenzie's survey of the coasts of the Bristol Channel, based on old methods of fixing by compass intersection, as the paucity of soundings indicates

Fig. 6. Part of the survey off the north coast of Kent by Lieut. Murdoch Mackenzie and Graeme Spence, the first survey for which the Station Pointer was exclusively used for fixing the position of soundings. (Orientated with the south at the top)

firmation of the fact that Michell did not understand the resection problem is apparent from the second part of his paper. For a proposed survey of the entrance to the Humber, angle observations were to be taken with the "Hadley" on two lights at the distal end of the Spurn. These would fix the vessel's position as lying on the arc of a circle passing through the two lights. The actual point along the arc could then be determined by compass bearings on one of the two lights.

Where John Michell failed, the ageing Mackenzie (Senior) succeeded. After retiring from active surveying in 1770, he compiled his 'Treatise on Maritim [*sic*] Surveying,' published in 1774. In the section dealing with position fixing at sea, he proposed an instrumental solution of the resection problem. The instrument in question consisted of a graduated semicircle of brass, 6 inches in diameter, to which three arms, one fixed and two movable, were attached. By means of screws, these arms could be placed so as to give the same angles as those observed with the "Hadley" and the whole instrument moved about on the draught until the arms passed simultaneously through the points observed on land (Fig. 4). To quote Mackenzie, "Such an instrument as this may be called a Station Pointer: and would be found convenient for finding the Point of Station readily and accurately." It seems that the book was already in an advanced state of preparation before Mackenzie either invented or was told of the instrument with its great possibilities for plotting soundings in marine survey. As a practical surveyor in the years between 1744 and 1770 it is clear that he himself had never used the instrument. Moreover, in the earlier section of his book where he deals with the methods used for surveying various types of coast, there is not one in which he advocates the use of the Station Pointer for fixing the position of shoals, rocks and individual soundings. In the list of instruments which he gives as necessary for the survey of a sea coast, a list which includes Hadley's 18-inch octant and 9-inch sextant, a theodolite, a good amplitude compass and two iron chains, there is also no mention of the Station Pointer. Thus the instrument must have been of very recent invention when the book was published in 1774, a conclusion further confirmed by the changing quality of marine surveys about this time.

When Murdoch Mackenzie (Senior) retired in 1770 he was succeeded in the post of Head Maritime Surveyor to the Admiralty by his nephew, Lieutenant Murdoch Mackenzie (Junior). Lieutenant Mackenzie continued where his uncle left off and in 1771 he was surveying in the Bristol Channel (Fig. 5). In the following year and the next, he remained in the West Country, first examining the north coast of Devon and then Cornwall. After measuring a base-line and establishing a system of triangles for a survey of Plymouth Sound in 1774, the younger Mackenzie was called away to survey a new channel off Margate in Kent. Whereas his West Country surveys were very similar in appearance to those of his uncle, with only a few scattered soundings inserted on the charts, the new survey of Margate Roads contained a wealth of hydrographic detail. Sandbanks like Margate Sand were carefully delineated as well as the maze of intricate channels through the shoals. For the first time a systematic coverage of the sea bed, based on close sounding, had been made (Fig. 6). This was possible using the "Hadley" for measuring horizontal angles and then applying the principle of resection. The basis of the survey was a base-line measured on the back of Margate Sand at low water and this was connected to a coastwise triangulation. Graeme Spence, who acted as assistant during the survey and later prepared a set of sailing directions for the area, stated that "the water work was surveyed by sextant angles between the several fixed objects on land and no compass bearings were used to fix or protract the work."[17] Thus in 1775, Mackenzie (Junior) and Spence were already applying the principles of

resection laid down by the elder Mackenzie in his book on marine surveying issued the previous year. Whether or not they were using an early form of Station Pointer, possibly constructed by themselves, is not recorded. Graeme Spence is usually credited with the invention of the instrument, but as he was only seventeen at the time this hardly seems likely. It is more reasonable to suppose that at a later date he perfected an existing instrument and this would explain the reference in Dawson's 'Memoirs of Hydrography' to his "inventing" the Station Pointer "which was shown to Lord Howe, the First Lord of the Admiralty who was pleased to order others of the same pattern, of Troughton the skilled instrument maker." In a few years the Station Pointer was destined to become an indispensable part of every hydrographic surveyor's equipment.[18] The ground was now prepared for the great task of charting the world which the newly founded Hydrographic Office was called upon to do during the nineteenth century.

Acknowledgements.—The author is indebted to the Hydrographer of the Navy for facilities for examining documents in the archives of the Hydrographic Department. Figures 2, 3, 5 and 6 are based on surveys and charts in this department and are reproduced with the permission of the Hydrographer of the Navy and the Controller of H.M. Stationery Office. Thanks are also due to Mr. R. A. Skelton for his helpful comments after reading the manuscript.

NOTES

[1] Hooke, R. "To sound the depth of the sea without a line." *Phil. Trans.* No. 9 (1662), p. 147.

[2] Collins, J. "A Chorographical Problem proposed by Mr. Richard Towneley and solved by John Collins." *Phil. Trans.* No. 69 (1674), p. 2093.

[3] "Three Chorographical Problems solved by a member of the Philosophical Society of Oxford." *Phil. Trans.* No. 177 (1685), p. 1231.

[4] Taylor, E. G. R. 'The Mathematical Practitioners of Tudor and Stuart England,' p. 272.

[5] Gunther, R. T. 'Early Science at Oxford,' Vol. 6, p. 249.

[6] Both these manuscript charts are included in Lord Burghley's collection at Hatfield House. A copy of Norman's chart is included in the author's "The changing navigation routes of the Thames Estuary." *J. Inst. Navig.* 4 (1951), p. 370.

[7] Naish, G. "Hydrographic surveys under the later Stuarts." *J. Inst. Navig.* 9 (1956), pp. 47–53.

[8] The method of survey used by Collins was probably not greatly different from that outlined by John Love in his 'Geodaesia' (1688) for the survey of a river mouth, *i.e.* a preliminary land survey and fixing of shoals, etc., by compass intersection.

[9] Pepys, Samuel. "Naval Minutes." Navy Records Society, Vol. 60, p. 388.

[10] Taylor, E. G. R. "Robert Hooke and the cartographical projects of the late seventeenth century." *Geogr. J.* 90 (1937), p. 540.

[11] McPike, E. F. "Correspondence and Papers of Edmond Halley." Letter dated January 27th, 1701/02. I am indebted to Mr. George Naish, Assistant Keeper at the National Maritime Museum, for this reference.

[12] *Phil. Trans.*, 27, 420 (1733), pp. 147–57.

[13] Owen, H. 'The life and works of Lewis Morris,' p. 156 (1951).

[14] Owen, H. (Ed.). "Additional Letters of the Morrises of Anglesey." *Y Cymrrodor* 49, part 1 (1949).

[15] Robinson, A. H. W. "Early hydrographic surveys of the British Isles." *Emp. Surv. Rev.* 11 (1951), pp. 60–5.

[16] *Phil. Trans.* 55 (1765), p. 70.

[17] Spence, Graeme. 'Nautical Descriptions of the Banks and Channels in the Thames Estuary' (1804).

[18] When Murdoch Mackenzie's 'Treatise on Maritim [*sic*] Surveying' was re-issued in a revised form by James Horsburgh in 1819 the following footnote appears in the section dealing with instruments: "Station Pointers are now made by most mathematical instrument makers and frequently used by surveyors."

A JOURNEY IN NURISTAN

WILFRED THESIGER

NURISTAN IS THE little-known part of the Hindu Kush which lies inside Afghanistan to the north of Jalalabad along the Chitral border. Sir George Scott Robertson was the first European to visit this country, when he spent a year in the Bashgul valley in 1889 while serving as British agent in Chitral. Nuristan was then independent, and was known as Kafiristan and its inhabitants as Kafirs. Kipling wrote his famous story "The man who would be king" about this country. However, in 1893 Sir Mortimer Durand reached agreement with Abdur Rahman, the Amir of Afghanistan, about the frontier between India and Afghanistan, and by this agreement Kafiristan fell almost entirely inside Afghanistan. Only a small area remained inside Chitral which is inhabited, even today, by pagans known as Black Kafirs. The other Kafirs were forcibly converted to Islam when Abdur Rahman overran their country in the winter of 1895–6, in a campaign which was skilfully conducted and only lasted four months. The main attack came from the valley of the Panjshir, but smaller forces also invaded the country from Badakhshan in the north, and Laghman in the south. After it had been conquered, Kafiristan was renamed Nuristan or "The Land of Light." Two important German expeditions travelled extensively in Nuristan in 1928 and 1935, and today the Nuristanis refer to all Europeans as Germans. A Danish expedition has also recently worked in certain parts of this country.

I had long been anxious to visit Nuristan, but permission to go there has always been difficult to obtain from the Afghan Government. I received this permission in the summer of 1955, but had by then decided to travel in the High Atlas in Morocco. I arranged, however, to go to Nuristan in the following autumn. John Newbould had travelled with me in Morocco, and hoped to accompany me to Nuristan to collect plants for the British Museum, but when I emerged from the marshes of southern 'Iraq, where I had spent the spring and early summer of 1956, I learnt that the Afghan Government had refused to give Newbould an entry visa. He was to have brought with him the collecting material, aneroids and other instruments. I knew that there were presses and blotting paper in Kabul, left over from my journey in the Hazarajat in 1954; there was, however, no time to get the other things sent out from England. It was particularly unfortunate that I did not have an aneroid with me on this journey.

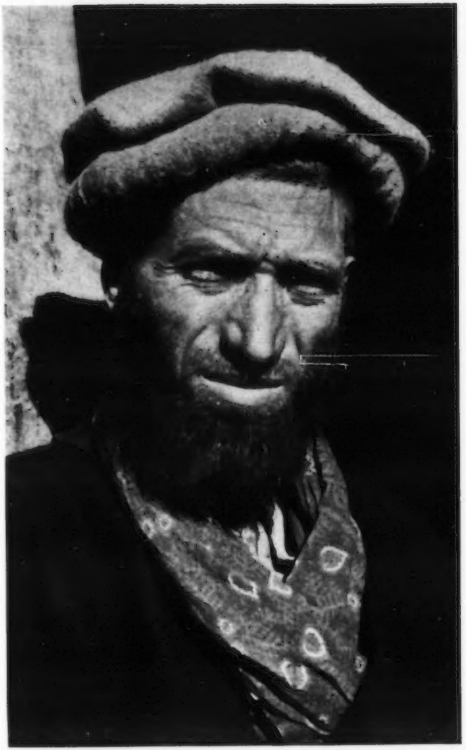
I arrived in Kabul on July 18. My arrival coincided with the Eid festival, when all Government offices were shut, and in consequence it took me ten days to get the necessary travel permit to visit Nuristan. The Faculty of Literature in Kabul very kindly allowed one of their students, a young Pathan named Abd al Nawab, to go with me as my interpreter. Clifford Jupp of the British Embassy took me up the Panjshir valley as far as Kachu, where he had arranged to have a Land Rover available for Hugh Carless who, with Eric Newby, was trying to climb the 20,000-foot-high peak of Mir Samir on the Nuristan border.

At Kachu I engaged a Tajik boy to cook and two other Tajiks with two horses to carry our baggage. I was assured that it was possible for horses to cross the Hindu Kush into Nuristan and to travel down the Ramgul valley at least as far as

Puchal. This proved to be so, but I should have done far better to have taken Tajik porters from the Panjshir, and to have kept them with me all the time I was in Nuristan, instead of relying upon Nuristani porters when we sent the horses back. We travelled for five days up the Panjshir valley. The river was deep and the bridges were few and far between. The valley was narrow and the foothills, which ran down to it on either side, were covered with screes and bare earth. These foothills hid the high mountains which lay behind them, and only occasionally did we get a glimpse of the snow. A strong wind blew continuously up the valley and it was very hazy. There were small villages and scattered farmsteads in the valley bottom, and a ribbon of small terraced fields and orchards along the river, where wheat, barley, maize, and small patches of clover, vetch and beans, and a little tobacco were cultivated. Most of the fruit trees were mulberries, but there were also apples, apricots and walnuts, and there were clumps of poplars. The inhabitants of this valley were Tajiks. They wore long coloured cloaks of striped material over white shirts and trousers, and many of them wore waistcoats. Most of them wore turbans, white, black or blue in colour, but a few of them wore only skull caps. In the side valley of the Dara Hazara was a colony of Hazaras who are Sunnis, as are all the Tajiks. The other Hazaras in Afghanistan are Shias. The road to Badakhshan followed the valley and my men referred to it as the road to Turkistan. Most of the time we travelled in company with Tajiks, Kuchis, or occasional Nuristanis, who were going our way. In many of the villages were *shai-khanas* (tea shops), and we stopped at most of them, sometimes for a cup of tea, but more often so that my companions could inhale a few quick puffs from a hubble-bubble. At Shanaize I met Hugh Carless and Eric Newby, who had made a gallant but unsuccessful attempt to climb Mir Samir, and had then travelled down to Puchal in Nuristan and come back to Panjshir over the Arayu pass. We spent a very pleasant evening together, and I got some very useful information from them about the country ahead of me.

At Pase Akib I left the main valley, which comes down from the Anjuman pass, and followed instead the Chamar, which rises under Mir Samir. We were now too high for permanent villages. Here the valley was only inhabited during the summer, when both Tajiks and Kuchis take their herds up there for the grazing. We soon passed some Kuchi encampments belonging to the Chanzai tribe. These Kuchis are nomadic Pathans and they live in black tents, whereas the Tajiks, when camped on the mountains, build themselves stone shelters, often under overhanging rocks. The Tajiks call their summer encampments *ailoqs*. We followed the valley bottom which was covered with green turf, except where it was buried under landslides. The mountains on either side were precipitous and rocky with some snow along their tops. On the second night after entering the Chamar valley we camped in an *ailoq* under Mir Samir. It was very cold up there and it snowed a little during the night. Next morning we crossed the Chamar pass, which I judged to be about 16,500 feet high, and entered Nuristan. There was a magnificent view of Mir Samir (19,880 feet) from the pass. The summit of this mountain was covered in snow, but I was surprised to see how little of it there was on the surrounding mountains; near the pass there were only a few drifts. We dropped steeply down into the valley on the far side, which is also called the Chamar, and camped in an empty *ailoq*. The only fuel here was pin-cushion vegetation and cow dung, which was plentiful round the *ailoq*. The Tajiks who were with me were frightened of the Nuristanis and anticipated that we might have trouble when we met them. Towards evening half a dozen Nuristanis turned up in our camp; they had seen us

Mir Samir, in the Hindu Kush (19,880



Nuristani in the Ramgul, near Puchal

Nuristani boy, Linar Valley

in the distance and had come down from their *ailoq* further up the valley to find out who we were. They were very friendly, invited us to come and spend the night with them, and, when we declined their invitation, they settled down to entertain us by dancing and singing. In appearance they were like handsome Europeans, light in colour, with brown hair and beards, while several of them had grey eyes. All of them wore dark Chitrali caps, short dark-coloured overcoats which ended in a distinctive fringe at the bottom, thick homespun trousers and puttees. They had red scarves knotted round their throats, and all of them were bare-footed. They remained with us until sunset and then left, after inviting us to visit them next day. They moved away quickly and easily across very broken ground. These people are born mountaineers and would make magnificent porters. I have seen them carrying loads of butter down to the villages from their *ailoqs*, and travelling at a jog-trot, although each of them must have been carrying a load of more than 50 lbs. They carry the butter in skins fastened on their backs inside a frame made from two V-shaped sticks. Sometimes they carry loads on their backs in large V-shaped baskets.

It was far warmer on this side of the mountain and nowhere in Nuristan did I see any glaciers, although there were the moraines of old glaciers in all the high valleys. Next day we visited the Nuristanis in their *ailoq* at the top of the valley, where they welcomed us and gave us curds and some milk. There were many marmots whistling among the rocks. We then followed the valley down to Puchal, where we arrived two days later. As we descended the valley we came first to scattered junipers and small thickets of birch along the streams. Lower down the mountains were lightly forested with junipers and along the river banks were large juniper trees, willows and tamarisks. We had to cross the river repeatedly, on bridges of juniper trunks split in half and more than 20 feet in length. The Chamar enters the Bugulchi, or Dara Rast, above Puchal, and the river is there generally known as the Puchal. Names are confusing in Nuristan since they have abandoned some of the old Kafir names. The whole of this valley is the Ramgul, and the tribes who live here were also called the Ramgul, but today many of the younger men do not know this name and call themselves Nuristanis. The valley to the east is the Kulam, and both the valley and the tribe who live there are still called by this name. Still further to the east they also use the old names, Kti or Kantiwar, Presun and Waigal.

The country round Puchal was magnificent—the valley was very narrow and the mountains rose above it, jagged and very sheer, their lower slopes thickly wooded with holly oak. Puchal, the chief village in the Ramgul valley, is divided into two parts and numbers in all about forty houses. It is the religious centre for the district, and the mullahs were fanatical and unpleasant, making no secret of their hostility to me as a Christian. When I returned here for the third time, after an unsuccessful attempt to get into the Kulam from the Wanasgul, a mullah rushed down the hill side towards us and poured out curses on me for defiling this stronghold of Islam with my presence. It was the fanaticism of the newly converted; his father must have been an infidel for the country had only been converted to Islam sixty years ago. The houses, built of mud and stones, were flat roofed and many of them were in two stories. In the villages they were crowded together one on top of the other up the hill sides, but many were situated by themselves in the fields and orchards. The richer houses were comfortable and some of them were warmed by flues built under the floors. There were no furnishings in any of the houses other than carpets, pillows and mattresses, and a few rickety rope beds. Most of these

Nuristani in the Ramgul, near Puchal

houses were remarkably free from bugs. When I had been in the Kafir villages in Chitral the bugs had been appalling.

The almost invariable diet of these Nuristanis was bread, made from wheat, barley or maize, with curds or cheese. They have some chickens and eat eggs, and they also eat fish. Robertson said in his book 'The Kafirs of the Hindu Kush,' that the tribes in the Bashgul would not under any circumstances eat fish. If in the past they had this prejudice in the Ramgul valley they have now abandoned it. At the beginning of the winter when they are killing off surplus stock they eat a certain amount of meat, but while I was there I was never given any meat, other than chickens, in their houses. It is always difficult to buy flour and this makes travelling with porters difficult. It is even more difficult to buy butter, although they produce good quantities in their summer camps. They invariably say that the butter does not belong only to them but is the joint produce of several families. In the past the Kafirs were famous for the wine which they made, but as a result of their conversion to Islam they no longer make any, at least not in the districts in which I travelled. Tea is a luxury in their houses, and sugar is almost unprocurable. In the autumn fruit, of poor quality, is abundant—apples, pears, apricots, peaches, pomegranates, grapes and walnuts. Much of this fruit, especially the mulberries, falls to the ground and rots, and walking through the orchards I was often struck by the strong smell of fermenting fruit which they are lazy about collecting, although they do dry a certain amount on their roofs. They have no difficulty about firewood in their villages as all the mountainsides are heavily wooded, especially with holly oak. I saw no pines in the Ramgul valley but there were forests of edible and blue pines in the Kulam valley and also in the Pashaie country to the south. The people use the wood of resinous trees as torches for lighting their houses after dark.

The Nuristanis grow wheat, barley, maize and sorghum, as well as broad and runner beans, in small terraced fields, and they cultivate some vegetables, such as tomatoes and marrows, round their houses. All their crops are watered by small irrigation channels, which convey the water from the river along the hill sides, but I saw no rain cultivation here, such as I had seen in the Hazarajat. Most of the work in the fields appears to be done by the women, who certainly do most of the harvesting and cutting of the hay. These tribes do not grow nearly enough grain for their own requirements but they do make large quantities of butter in their summer camps, which they keep in the ice-cold streams until there is enough to take down to the villages—there it is boiled and then carried down to Laghman, or across the Hindu Kush to Panjshir for sale. They bring back the grain which they require from these places, especially from Laghman, and there are watermills for grinding corn in most of the villages.

They weave a thick, heavy cloth, usually of a dark colour, for their clothes, and they also make rugs. There are looms outside many of the houses. They do not make felt as they do in the Hazarajat. Even in 1889 Robertson noted that the Kafirs had no particular dress of their own, but wore indiscriminately the clothes of neighbouring tribes, and this is especially true today. Some of them dress like Tajiks, others like Pathans. They wear Chitrali caps, turbans or skull caps as the fancy takes them. Their only indigenous dress seems to be a short overcoat with a fringe round the bottom, and the habit of wearing gay-coloured scarves knotted round their throats is also peculiar to them. They are often bare-footed, at any rate in the summer and autumn, but some of them wear soft leather boots similar to those worn in Chitral. Many of them sew charms and coins onto their jackets.

The young men and boys paint round their eyes with a red juice and also use antimony on their eyelids, which gives them a strange and rather dissipated appearance. The women do not veil, but are extremely shy, turning away or hiding themselves whenever I drew near. They are fond of red as a colour, especially for their undergarments. The boys often carry double-stringed bows for shooting stones and spend much time shooting at birds, although they seldom hit any; I saw similar bows in Chitral. Many of the household utensils, such as dishes and milk pails, are made of wood often decorated with crude incised patterns; their cooking pots are of iron but they seldom own a kettle.

From Puchal we travelled down the valley and after 6 miles we passed Sang-i-Navishta, where on a face of rock above the peak is an inscription by Abdur Rahman celebrating his conquest of Kafiristan, and another inscription, which is attributed by the locals to Timurleng who passed through this country in 1398, but the light was bad and the inscription was high up and I could make nothing of it. We continued down the valley to where the Linar enters it from the north. Three miles below this point the river enters the Mandul lake, quite a small piece of water, perhaps half a mile across at its widest. It is said to be full of fish which the Nuristanis catch with nets. They told me they sometimes catch fish weighing up to 100 lbs. or even more. There were half a dozen cormorants on this lake, and otter tracks in the sand at the water's edge. Several boys were bathing here and like all Nuristanis they were extremely good swimmers. Above the lake the river flows slowly through wide meadows, where women were busy cutting the hay as we passed by. Below the lake the river enters a rocky gorge, and the track beyond this point is said to be impassable for animal transport. The hills above the lake were heavily wooded with holly oak. We travelled up the Linar valley and eventually camped at the foot of the Arayu pass, but we were delayed for three days before we got there. Our horsemen, despite constant warnings, plunged their horses into deep water crossing the river, instead of unloading them and carrying our kit over a plank bridge. The loads were soaked and in consequence of the row which ensued I decided to get pack ponies from the Nuristanis. These ponies were on the high pastures and, when they were eventually produced, were unshod, which caused still further delays, until at last a blacksmith was produced to shoe them. Two days earlier one of the Tajik horsemen had trouble with a Nuristani who claimed that our horseman owed him some money. The argument had gone on for some time when suddenly in a narrow length of path the Nuristani struck the Tajik to the ground, where he lay weeping with his nose streaming with blood. I threw the Nuristani off him as he was preparing to strike him again. Abd al Nawab handled the situation with skill and made the Tajik pay up the money which he undoubtedly owed.

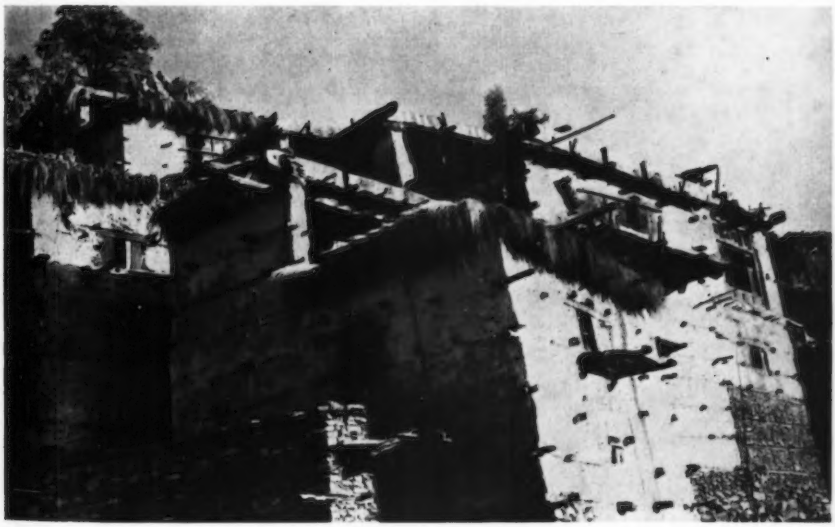
I climbed to the top of the Arayu pass where I got another view of Mir Samir, towering over the surrounding mountains. We then returned to Puchal. I now decided to continue up the valley to the Wanasgul, and to cross from there into the Kantiwar and then back into the Kulam valley. We left Puchal on August 18. In the evening as we were going along a narrow path a few feet above the river one of our horse's loads caught on a projecting rock; the horse struggled to pass and was forced over backwards into the river, where horse and load were completely submerged. The horse found its feet and started out into the stream. Its load had slipped under its belly. It would undoubtedly have been drowned in the rapids, which were only a short distance downstream, if a boy who was with us had not immediately jumped into the river and turned it back to the bank. Everything I

had with me was soaked. My large collection of plants was a sodden mass of blotting paper; the two boxes containing my films, spare lenses, notebooks, passport, money and clothes were filled with water. There was nowhere to camp except on the narrow path and here we struggled to dry the plant collection before it grew dark. Luckily there was only a slight breeze instead of the strong wind which normally blew at this hour, but our task was not made easier by strings of women who came down the path carrying loads of wood. We got the last plants dry just as it got dark.

Next day we travelled up the Wanasgul. We passed through woods of oak, willow and various kinds of thorn trees, and then through thickets of birch and scattered junipers. The valley bottom was damp and very green. We were accompanied by four Goujars, on their way back to Kantiwar, who were carrying very heavy loads of flour. They had come down to Puchal a few days before to get their corn ground at the mill. These Goujars, who looked very Indian beside the Nuristanis, have a bad reputation and are universally unpopular in this country. They spend the summer in the mountains and winter in the valleys near Laghman. There are no Kuchis in Nuristan, which is one of the few mountain areas in Afghanistan where they do not penetrate. We camped that night in an *ailoq* high up in the valley, where the scenery was magnificent, the mountains towering above us, streaked with snow. There were six men and a small boy at this *ailoq*. Like all these *ailoqs* it consisted of a few small, crudely built, stone cabins, roofed with bushes and earth supported on poles, and some stone shelters, open to the sky. We bought a sheep for dinner. These Nuristanis do not own large flocks of sheep or goats nor many cows, but nearly all families own a few animals. Several families usually join up to form an *ailoq*, moving their animals up to the summer pastures in May and back again to the village in September. During the winter they feed them on hay, using stalks and the dried leaves of various plants, such as rhubarb and hog weed, which they collect during the autumn and stock either on the roofs of their houses or in the forks of trees.

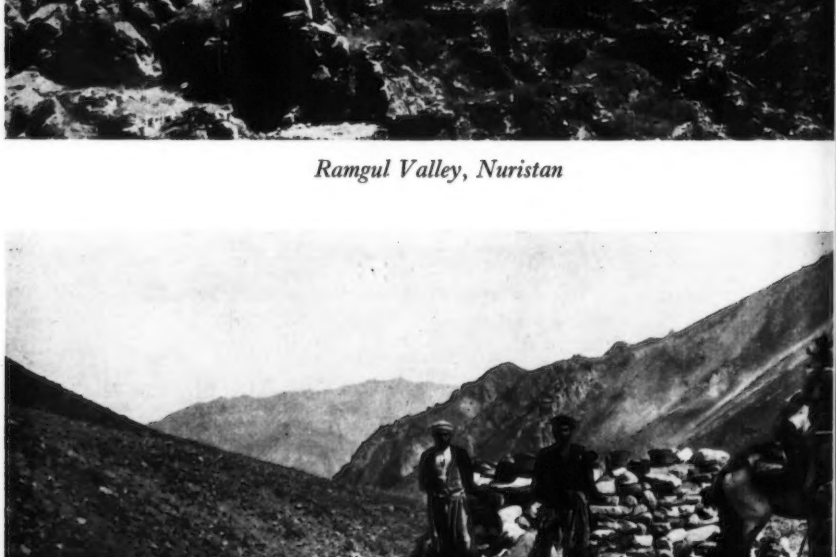
Next day we climbed the pass. It was a steep climb, the going was appalling for horses and there was no visible track. Tumbled boulders were piled on a great bed of plutonic rock. It had been smoothed and scratched by ice, and was split and riven into segments, which were often very regular. The rock, a pale grey in colour, was covered with a dark, almost black, patina so that it looked like basalt. This was typical of the rock throughout those parts of Nuristan which I visited, although in some places there were considerable igneous intrusions. I climbed to the top of the pass into Kantiwar but it was quite impossible to get horses through this chaos of tumbled rocks. Eventually as it grew dark we got them across onto the mountainside above the Nau Swan, which runs parallel with the Wanasgul, and camped there. There was no firewood and no water, and we had had nothing to eat all day. It was bitterly cold. We spent the next morning trying to find a way down into the valley bottom, but it was hopeless. Eventually I sent the horses back unloaded with Abd al Nawab and the two horsemen to the *ailoq* in the Wanasgul, while I stayed with our Tajik servant and the baggage on the mountainside. I think we were camped at about 15,000 feet. We had a small Meade tent and enough solid fuel for our requirements. From our camp we looked out across range upon range of mountains, where jagged serrated peaks, precipices and hard rock faces looked grim and desolate. Throughout the night small avalanches crashed down off the ice walls opposite us. Next morning the two horsemen arrived and we carried our baggage down to the *ailoq*.

Puchal: capital of Nuristan



Pashaie homes, near Junia

Ramgul Valley, Nuristan



A Nuristani ailoq *at the head of the Wanasgul*

Abd al Nawab was very worried. The Nuristanis at the *ailoq* had told him that six well-known brigands armed with rifles had followed us from Puchal and made enquiries about us at the *ailoq*. They were from Ramgul and did not wish to rob us in Ramgul territory, but were planning to ambush us on the Kantiwar side of the pass, as they were on bad terms with that tribe. I was sceptical about this. Abd al Nawab had found out that there was an easy pass from the *ailoq* into the Kulam valley. The horsemen refused, however, to attempt any more passes and insisted on going back to Puchal. In the morning while we were discussing this, the owners of the *ailoq* said that they did not care where we went, but that we must leave at once, since our presence in the *ailoq* endangered them as the brigands might come back at any moment. We got back to Puchal that day and I paid off the horsemen and hired porters to take us across the mountains to Kulam. We had continuous trouble with porters from now on. The Nuristanis carry well, but realizing that we were dependent upon them, they demanded exorbitant wages. Several times our porters put down their loads on some bare mountain side and demanded a rise in pay. This led to continuous friction—which was a pity, for it left me eventually with a poor impression of them. The Nuristanis are a cheerful race, humorous, always ready to laugh, usually good tempered and extremely energetic, but they are unreliable, quick tempered, avaricious, treacherous and thievish. The mullahs and elders are fanatical, but the ordinary people are not, although all of them, even children, say their prayers with great regularity, and nowhere have I heard so many calls to prayer as I did in these Nuristani villages, the words a strange travesty of the original Arabic. They are extremely fond of singing and dancing—they play a viol, similar to that used in Chitral, which has either three or five strings, drums and reed pipes. Many of their songs are in Persian, some of them in Nuristani. All of them are tuneful with curious rippling melodies, often rather melancholy. The Nuristanis are nearly all bilingual, speaking Persian as well as their own language which has several dialects. Ramgul, Kulam and Kantiwar speak the same dialect, which differs from those spoken in the Pech valley and in the Bashgul valley. In fact, during this journey we met few people who could not speak Persian although practically none of them spoke Pushtu.

The porters carried magnificently and we reached Kulam in one day from Puchal. We climbed 6000 feet in a long steady grind. There was no water here until we were near the top of the mountain, an unusual circumstance in these parts. We stopped at an *ailoq* for a short rest on the mountain top, and ate curds and cheese. The mountains in this country are usually ridge-backed, and this was the only place I saw where there was a plateau. There were excellent grazing grounds here, used by the Kulam tribe. In most places the *ailoqs* were in the villages and the animals grazed on the steep mountain sides. The hostilities between the Ramgul and Kantiwar tribes had started over a dispute about a plateau grazing ground. The descent into the Kulam valley was very steep, and I was thankful that we were going down it instead of climbing up it. From the top of the pass, which I think was about 14,000 feet, there was a tremendous view to the east across precipices and gorges, thrown together in apparently hopeless confusion. We reached Kulam ten and a half hours after leaving Puchal. Kulam village, the largest in this valley, consisted of about twenty houses, situated on a spur at the junction of two valleys, and has magnificent views up and down these valleys. The surrounding mountains are forested with junipers, and edible as well as blue pines.

We spent two days at Kulam bargaining with new porters, and then travelled

down the valley to its junction with the Ramgul. It took us two days to get there, and for the last 5 miles we passed through an impressive sheer-sided gorge, along a track which would be impossible for animal transport. Below the junction of the two valleys the hillside was covered with small piles of stones, commemorating the Muslims of Abdur Rahman's army who had been killed in battle here by the Kafirs. We were now in Pashaie country; the Pashaie were originally Kafirs, but were forcibly converted by Abdur Rahman shortly before he conquered Ramgul and the rest of Kafiristan.

We visited the Government post at Junia, the first such post that I had met with on this journey. The river below the junction of the Ramgul and Kulam is known as the Alingar, and flows in a deep gorge through uninhabited country. We were advised not to follow the river, but to travel through the mountain to the west of it, and this we did. The mountain sides were thickly forested with holly oak, edible and blue pines, and junipers, and the ridges between the successive valleys were steep. We spent three nights in Pashaie villages. These people are quite different to the Nuristanis, being darker in colour, gentler in appearance and speaking a different language. They certainly appear to be a different race. They paint their eyelids, and sometimes even their eyebrows, which gave them an odd appearance; the young men and boys wear necklaces of beads, and put flowers in their caps and frequently carry small bunches of flowers in their hands. Many of them had flat metal ornaments in their ears, and most of the younger men were naked from the waist up, although a few of them wore goat skins across their shoulders. On one occasion we were put up in the local mosque, which would certainly not have happened in Nuristan. The women here were not the least shy. The houses, too, were quite different from any which I saw in Nuristan; they were better constructed, and the outer walls were given a plaster finish. The most distinctive feature of these houses was a fringe of cut grass, held down by stones, which was round the top of the parapet on the roofs, to run off the rain. In several places in the fields I noticed an ingenious arrangement for scaring bears. A small wheel was turned by the water in a stream and this revolved an upright stick to which two arms were fastened. These arms hit a board and made a loud and continuous noise. Bears are common and do much damage to the crops, especially the maize. Both the black and brown bears are to be found in Nuristan; there are also leopards. Ibex are to be found in many of the mountains and markhor in others, especially the more forested ones. We entered the Alingar valley above Shahi, where the people were Pathans. We got hold of new porters and travelled down the valley to Kalatussiraj in Laghman, where we arrived at mid-day on September 4. After lunch Abd al Nawab and I hired a tonga and arrived in Jalalabad at sunset.

During this journey I collected specimens of plants, which are now in the Botanical Department of the British Museum (Natural History). I also made a compass traverse and sketches of my route which have been worked out by Mr. Holland and the Society's draughtsmen, and produced the map which accompanies this paper, and is to be found at the end of the *Journal*. I am extremely grateful to the Afghan Government for giving me permission to make this most interesting expedition, and to Abd al Nawab for all the help he gave me during the journey.

THE DEVELOPMENT OF VEGETATION PATTERNS IN SOMALILAND PROTECTORATE

J. E. G. W. GREENWOOD

A DISTINCTIVE DISTRIBUTION of vegetation in a series of arcuate bands was observed on aerial photographs by Dr. W. A. Macfadyen in Somaliland Protectorate in 1947–8. Macfadyen drew attention to the phenomena in a letter to *Nature* in January 1950[1] and in a contribution to the *Geographical Journal* in that year.[2] He referred to the bands of vegetation as "vegetation arcs" and to linear stretches of virtually bare ground cutting the arcs as "water lanes." Vegetation arcs are not only of general ecological interest but also of use in studies of water supply, as Macfadyen points out[3]; they may be of interest to the pedologist and have a bearing on the question of soil erosion. In the account published in the *Geographical Journal* Macfadyen discusses the origin of vegetation arcs and indicates the importance of the part played by water in their formation.[4] His final conclusion, however, is that the origin of both vegetation arcs and water lanes is obscure and needs further investigation.

In 1955–6 the writer, whose work involves geological interpretation of aerial photographs, visited Somaliland Protectorate and had the opportunity of seeing vegetation arc terrain from the ground. In this connection it may be noted that the existence of arcs would probably have gone unnoticed without prior location on aerial photographs. The attempt is here made to describe the factors considered to be relevant to vegetation arc formation, and to combine these in an explanation of vegetation arcs. The study refers to Somaliland Protectorate but could apply equally to other areas with comparable conditions.

Summary of relevant factors

A summary of the main factors affecting arc formation must include rainfall linked with soil texture. Vegetation arcs occur over areas of the Protectorate where yearly rainfall varies from about 4 inches (in the east and south-east) to 17 inches (in the west). Rainfall occurs in two seasons, roughly from April to June and from September to November. It is irregular in distribution; not infrequently it takes the form of heavy downpours giving rise to sheets of run-off water. Over much of this terrain the surface deposits contain a comparatively high percentage of clay, either throughout the soil profile or in a relatively impermeable illuvial "B" horizon, a fact demonstrated by the occurrence of *ballehs* or temporary ponds. The significance of this will be discussed later. Vegetation arcs have not been seen on sands where conditions would otherwise seem suitable for their formation. They are well developed in the Haud and Sawl Haud areas. In addition to Somaliland Protectorate, less impressive vegetation arcs have been noted on aerial photographs of Kenya and Tanganyika, and their occurrence seems to be restricted to areas of rainfall not much exceeding 20 inches annually, generally incident in two seasons.

Topography plays a critical part in arc formation since arcs occur only on ground having a gradient sufficient to cause surface flow, but insufficient, in conjunction with rainfall, to produce defined drainage lines. Commonly, the slope of ground carrying arcs is slight enough to be hardly perceptible in a stereoscopic examination of photographs. The degree of slope appears to affect the curvature and spacing of

vegetation arcs. The nature of the bedrock does not appear to be directly significant. Arcs are seen in various territories to overlie Basement Complex rocks, Volcanics, and Tertiary sediments. In the Protectorate, underlying rocks are believed to be mainly Cretaceous sandstones, Lower Eocene limestones, and Middle Eocene limestones, gypseous shale and anhydrite. It is considered that wind action is not in any way closely connected with vegetation arc formation.

In an attempt to explain vegetation arcs two questions arise: firstly why vegetation should depart from a "normal" distribution dictated by ever present variations in ecological conditions, and secondly, why it should take the form of more or less arcuate bands. The questions are interrelated.

Use of the term "vegetation arc"

The idea evoked by the term "vegetation arc" is partly misleading since, in fact, the arc form clearly recognized as such is but one expression of several similar patterns governed by common factors. These factors lead to a series of bands of vegetation of greater and lesser lateral extent, some of which are so limited as to appear as clumps, or elongated patches, on aerial photographs. Truly arcuate bands of vegetation are particularly well seen in shallow valley-like waterways in low, hilly topography. These arcs are convex up-slope, but on some low ridges vegetation bands may be convex down-slope. In this case the shorter individual bands which make up the arc unit are again convex up-slope. On plains having the minimum gradient commensurate with production of vegetation arcs, such "arcs" may approximate to straight lines.

Water supply and soil texture

Of the factors influencing vegetation growth, that of water supply is of paramount importance in the semi-desert conditions obtaining over much of Somaliland Protectorate. The amount and distribution of rainfall in relation to perennial plant growth must be evaluated with reference to soil type since the capacity to absorb moisture and to retain it against gravity and against evaporation, as also against the suction of plant roots, varies considerably with the soil. This is well shown in Dr. J. Smith's studies of the distribution of tree species in the Republic of Sudan,[5] from which emerge several facts relevant to the present discussion. This study makes it clear that the minimum moisture requirement of a soil to support a given tree species is related to the clay content of the soil, and that throughout the Sudan a species requiring $3 \times x$ inches of rain on clay soils, requires less than $2 \times x$ inches of rain on sands.[6] The statement is made that clay soils in 500 millimetres of rainfall in the east (of the Sudan) carry species which need only 300 millimetres in the sandy west.[7] (The clay content of the western red sands varies between 5–20 per cent.; in the east, soils with 50 per cent. clay are common.) According to Smith, *Acacia mellifera*, Benth., a species known to occur in vegetation arcs in Somaliland Protectorate, grows on 20 per cent. clay soils in rainfall of 250 millimetres, and on 40 per cent. clay soils in 400 millimetres of rain.[8] In the Sudan, superior and more mesophytic vegetation is carried on inselbergs than on the clay plains in which they occur, despite a very high gravitational loss on the higher ground. It is also relevant to note that a given species of tree survives in least rainfall on coarse sands, hillsides, and gritty runnels, and that its sites in heaviest rainfall are flooded areas and non-absorbent (loam) soils on hard-surfaced slopes (slopes subject to sheet erosion).

The poorer standing of clay soils with respect to their capacity to provide moisture for plant growth is considered to be mainly due to soil/air evaporation, especially in the case of bare cracked clays. The soil/air surface in such soils is much greater than that in sands or sandy soils.

Consideration of the relation between precipitation and the soil texture goes far towards an understanding of vegetation distribution in wide areas of Somaliland Protectorate. Rainfall on the elevated areas results in deposition of the lighter fraction of weathering products (clay and silt grade particles) in the shallow valleys and lower ground in general; the mature stage which results from progressive erosion is a clay plain. The heavier fraction, including sand grade particles, is moved more slowly and sporadically in the spates, and perhaps also by wind action. The predominantly clay nature of the deposits of lower ground in the Haud is shown in records of wells sunk in the Protectorate.[9] (With reference to the Haud soil this interesting fact is recorded by Hunt[10]: "In the apparently porous red soil of the Haud, over which water had trickled after heavy thunderstorms on a nearly level surface for twenty-four hours (Qaidr Boleh, 1949) the water penetrated only nine inches." Hunt also states that the commonest surface deposit on the south side of the Main Watershed is a reddish calcareous sandy clay.[11]) Data from some of the well borings includes the following (top layers only are noted):

Arorigaban: 45° 03′ E. 9° 12′ N. 0–37 feet. Brown calcareous clay.

Bohotleh: 46° 19′ E. 8° 14′ N. Dug through sandy clay and limestone rubble. (? Kankar.)

Doboweina: 44° 52′ E. 9° 18′ N. 1–11 feet. Brown alluvial. 11–21 feet Red limestone cap. (? Kankar.)

Eik: 45° 20′ E. 8° 58′ N.

Well I. 1–128 feet. Soft brown calcareous alluvial with small pebbles.

Well II. 0–17 feet. Gypsum and powdery brown clay.

Well III. 0–103 feet. Brown gypseous clay.

Jifo Uri: 43° 25′ E. 9° 43′ N. 1–51 feet. Reddish brown gypseous clay.

Qoton Dabo: 44° 40′ E. 9° 12′ N. 0–112 feet. Terra cotta coloured sticky calcareous alluvial clay. No pebbles.

Soil texture and vegetation

A study of the distribution of tree and bush in the Haud and Sawl Haud shows that cover on higher ground is often more uniform and heavier than that in depressed areas of valley and plain. This is more noticeable in the areas of greater relief in the east. For example, near the Ethiopian boundary south-south-east of Las Anod, higher ground is well covered with tree and bush; plinth-like slopes at the base of higher ground, where surfaces are hard and sheet erosion active, are practically devoid of vegetation. The shallow valley-like waterways (with no incised drainage) have a lesser cover of tree and bush which is concentrated in arc form; here grass is also found. It may be that the remarkable change in vegetation from bush and tree country, to grassy plains or *bans* seen in areas of the Haud and elsewhere, is related to the clay content of the soils. It is to be expected that grass would form the vegetative cover on lower ground or basin-shaped sites where clay content is higher, and that more elevated tracts with less clay would carry tree and bush, assuming rainfall conditions are similar. Moisture available for plant growth would tend to vary inversely with clay content.

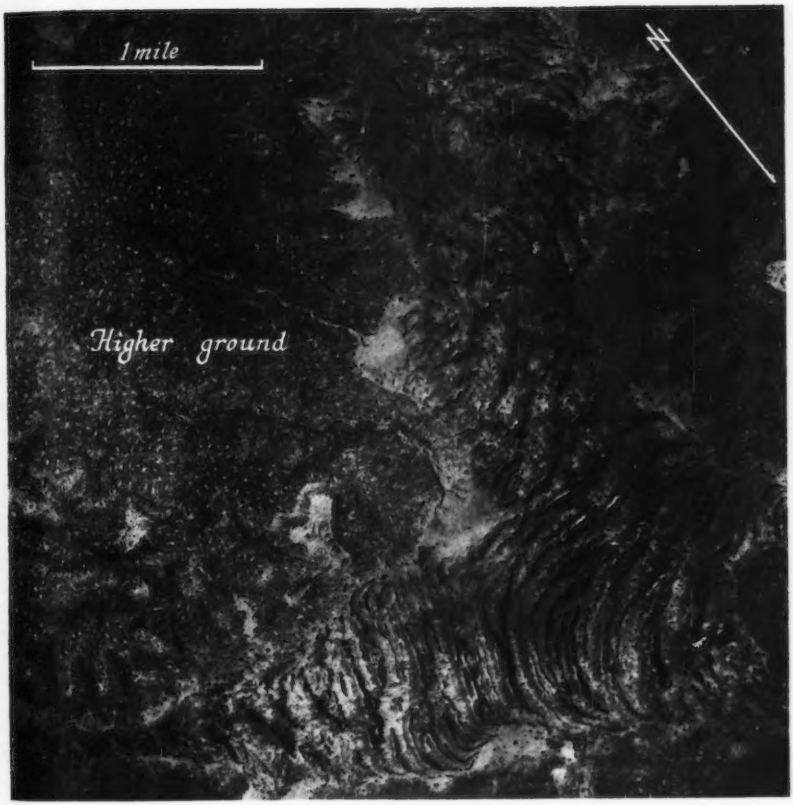
Enough has been said to indicate that the less elevated areas, where vegetation arcs are found, tend to have soils with a comparatively high clay content. Heavy

downpours resulting in run-off flow, as opposed to incidence by raindrops alone, result in the formation of a surface skin even on sandy soils. This process, rendering soil more impermeable, is encouraged by the clogging of pores with clay and silt carried in suspension. The loss of crumb structure by deflocculation arising from sodium salts carried in solution may also at times be a factor. Under the conditions of sparse irregular rainfall and high loss by run-off and evaporation, clayey soils are more or less incapable of supporting perennial growth. Since, however, soil in shallow waterways and valleys does in fact carry vegetation in bands or arcs this may be accounted for by the fact that the soil is rendered more permeable and less subject to evaporation loss in these bands.

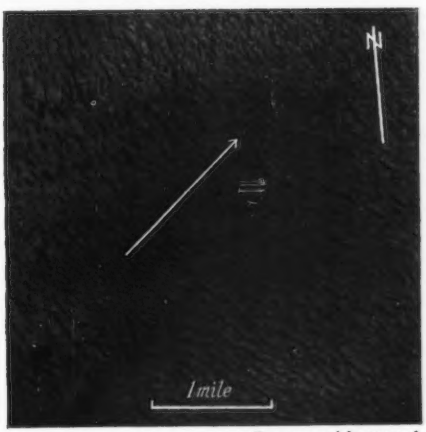
Development of vegetation arcs

Water moving over slopes of slight gradient at a low velocity carries clay and silt in suspension. Organic litter will float on this moving sheet. As mentioned above, heavier spates will move also the sandy fraction. The surprising abundance of animal excreta scattered throughout has been remarked by Macfadyen.[12] Since the load carried in suspension varies approximately with the 5th power of velocity, a slight check in the velocity of the slowly moving sheet of water would lead to the deposition of much of the load. Such a check would result locally from obstruction by obstacles such as logs, branches, etc., or from a decrease in slope. A vegetable litter mulch is the practical dry-land farmer's aid to conservation of moisture. The mulch allows increased penetration of water and reduces evaporation from the soil surface. Wherever vegetable litter and excreta are deposited from the run-off water, patches of soil better able to support plant growth are formed, and on such patches, grass seeds will in some cases germinate and grow. This is the basis of vegetation arc formation, and grass is the founder of these arcs. Run-off from succeeding rain storms carries further supplies of organic litter which is caught in the mat of grass growth, which itself holds up run-off and increases percolation, the grass roots improving the structure of the upper layers of soil. The deposition of litter take an arcuate form as the water impinges on the grass and forms curved trails on either side. The embryo arc, once its grass foundation is laid down, is able to trap sand and sandy silt carried in spates. Along the up-slope edge of arcs a lighter-toned band is clearly seen on photographs. This is considered to be the zone of accumulated sandy material which up-slope spreading vegetation has not yet colonized. The addition of sandy material reinforces and enhances organic litter as an effective mulch, and possibly also aids moisture retention by depressing soil temperatures by reflection of heat. It is probable that much of the lighter silt and clay fraction is carried through the dispersed vegetation of arc sites and deposited more or less uniformly along the shallow water way. Sandy material tends to be retarded by arc vegetation. Thus inter-arc areas retain their clay texture characteristics and remain bare of vegetation.

Following the early stage of a larger number of smaller vegetation arcs, the vagaries of minor topographical detail lead to the preferential development of a reduced number of arcs. The effect of a well-established arc in starving the immediately downstream area of moisture and the means to retain it for plant growth, leads to a spacing of arcs at such an interval that the inter-arc distance is just sufficient to provide enough moisture by rainfall and run-off to maintain the succeeding arc. (Cases are seen where fading arcs occur in the "shadow" area between two well established arcs.) The further supply of mulching material is of less importance once an arc is established since it is then largely self sufficient if moisture is avail-



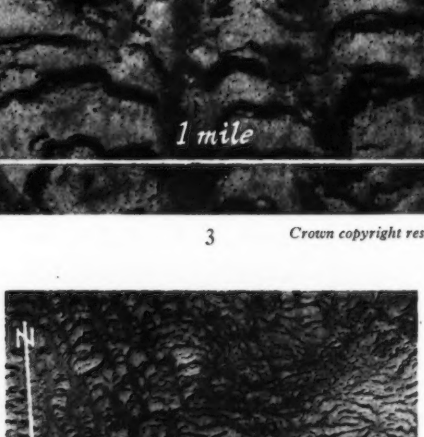
1 Crown copyright reserved: R.A.F. photograph



2 Crown copyright reserved: R.A.F. photograph

Vegetation patterns in Somaliland Protectorate. (*For explanations of plates see pages* 472–3)

3 *Crown copyright reserved: R.A.F. photograph*



4 *Crown copyright reserved: R.A.F. photograph*

Vegetation patterns in Somaliland Protectorate (see pages 472–3)

able. The original spacing of arcs depends upon the velocity of water flow (*i.e.* upon the slope) and upon the volume of transportable material. Embryo arcs always are convex up-slope. Established arcs are generally so shaped because most of them are formed in shallow water ways, and the front of deposition in such topography is convex upstream. As mentioned above, the developed arc may be virtually a straight line on very slight slopes and may be convex down-slope on gentle ridges. The latter again reflects the natural front of deposition on such terrain.

The growth of miniature arcs may be studied in a Surrey pine wood after a shower of rain. In this case the arc is formed of pine needles. The same result was achieved in rough experiments conducted by the writer using a gently inclined board covered with loam and vegetable fragments, and a watercan with a fine rose. A convincing grading of soil particles occurred, the lighter fraction accumulating at the bottom of the board. Vegetable debris arranged itself in several well formed arcs generally convex up-slope. Several large stones were placed on the board to provide obstructions, but it seemed that these did not engender arc formation as water tended to swirl and rebound from the hard surfaces. Arcs formed where debris impinged on some small stick or fragment of litter. The velocity and amount of flow appeared to be critical, and excessive wash reversed the convexity of arcs. This suggests that initial arc formation in nature occurs on the waning flood. It is not suggested however that an accurate inference can necessarily be drawn from this "experiment."

The thickness of the band of vegetation is dependent primarily on moisture supply. It follows that more water is necessary to maintain the larger and thicker bands and thus the inter-arc spacing must, *ceteris paribus*, be greater. This conclusion is supported by reference to the photograph and is in accord with measurements of rhythmic frequency of arcs by Macfadyen, who found that the interval of a sequence of vegetation arc and its intervening desert averaged about 158 metres. In strongly marked arcs this figure was 216 and could be as much as 276.[13] In areas of vegetation banding south-east of Hargeisa where the slope is very slight, vegetation arcs are generally closely spaced and as a consequence are comparatively ill-formed and small.

The effect of a break of slope resulting in a flattening of the terrain, or of an actual depression in an arc area, is to produce an accumulation of soil with a high clay content. In such pan-like sites, despite the concomitant accumulation of water, the outcome is a condition of greater drought as far as plant growth is concerned. Such sites cannot support perennial growth but carry a cover of grass and other herbs. On aerial photographs they show as darker toned strips which appear to cut the vegetation arcs. The latter exist independently but merge into the grass as clay content increases. These grass strips are to be distinguished from the strips of bare ground termed "water lanes."

Migration of vegetation arcs

The fact that vegetation arcs receive much of their water supply by run-off suggests that migration up-slope of the whole system of arcs may be expected. An advancing sheet of water meeting the arc vegetation would tend to result in increased percolation on the up-slope margin where also the deposition of mulching sand or silt apparently occurs. There would thus be a tendency for optimum growth conditions to move up-slope. Vegetation arcs show a stronger up-slope development and a more ragged downstream margin which may be suggestive in this connection. Further, in the western parts of the Haud, arc development is mainly

confined to grass. These grass arcs can be seen to be slightly trough-shaped and to be backed down-slope by arcuate lines of trees on apparently slightly elevated ground. It is not to be expected that arc sites should be considerably raised since the slow-moving water sheets which produced them could not flow over appreciably elevated ground. However, the accretion of a certain amount of organic and alluvial (and possibly aeolian) material is bound to raise arc sites to some degree. The grass arcs occur in terrain of very slight slope and sheet flow would be at a minimal velocity. This leads to the development of a favourable growth area (by percolation, etc.) more clearly in advance (up-slope) of the established arc, *i.e.* a grass arc exists up-slope of the established arc of trees. It is suggested that the grass arc will in turn become the site of tree growth, and that this alternation may demonstrate the up-slope movement of arcs. Such movement implies that the general soil profile (but not the surface) would be similar in both arc and inter-arc sites, which is in accordance with existing information on this point. Attempts have been made to find photographic evidence of arc movement by stereoscopic study of Somaliland Boundary Commission photographs taken in 1930 in comparison with R.A.F. photography of 1952, both sets being adjusted to a common scale. Evidence of up-slope migration is not observable, however, and the comparison is confused because photographs were taken in different months of the year, which affects the grass growth, because the area is subject to considerable variations in annual rainfall, and because, above all, the time interval is insufficient to allow of movement measurable on aerial photographs at a scale of 1 : 30,000.

"*Water lanes*"

Ribbon-like tracts appreciably devoid of vegetation, which attract attention most readily by their distinctive appearance in areas of smaller, less well formed arcs have been previously termed "water lanes." The writer suggests that these may be strips of bare ground defined and constricted to a linear appearance by flanking vegetation. They are more or less straight because flanking vegetation arcs are arranged in a roughly linear series. The latter may be so arranged because the run-off water that leads to their inception although essentially a sheet flow, was channelled to a slight degree. The sub-parallel strips termed (perhaps incorrectly) "water lanes" mark, it is suggested, the line of former subdued ridges between incipient arc sites. The slight disparity in elevation would tend to be removed by equally slight elevation of the arc sites. However, it is probable that these former subdued ridge lines often remain sufficiently elevated to receive only a reduced water supply, and so remain sites inimical to plant growth. Their ridge-like character is destroyed at intervals where adjoining arc sites rise sufficiently high, and for this reason the stretch of "water lane" is broken. (That any form of "breaching" of arcs could lead to water lanes proper seems most unlikely on slopes which may not exceed a gradient of about 1 in 400.) These lanes may be thought of as extending backwards up-slope *pari passu* with arc formation, in which the overall development is likewise up-slope as progressively more higher ground approaches the mature plain stage, and in doing so reaches the phase when conditions are favourable for vegetation arc formation. At the same time it must be remembered that arcs will develop in shallow, and more or less separate, waterways before the plain stage is reached.

A note on soil profiles

An interesting light is thrown on the subject of arc formation by information received from C. A. Hodge of the Soil Survey of England and Wales, who

visited Somaliland Protectorate in 1955–6. His observations on the soil profiles in an area of grass arcs south of Hargeisa indicate that profiles in the arc and inter-arc area are apparently similar. In both, a fine granular structured brown loam "A" horizon overlies a "B" horizon of brown clay with a blocky structure. Much gypsum is recorded below 4–5 feet. The first point of interest is that the water soluble salts which increase with depth show a rise at some 8 inches depth in the inter-arc sites, but at about 24 inches in the arc sites. Secondly, it was observed that pothole-like subsidences of inverted funnel shape occurred within the arc sites only, and that soil under the pothole gave a pH value of >9·0 which is about ½ a unit higher than that given by an adjacent sample. The soil of much of the Protectorate is of the pedocalic type, as climatic conditions would suggest, and the typical layer of secondary calcium carbonate is found in many places. An explanation of the potholes might be that the normal soil type of high base status, with the principal cation of calcium, is converted to a sodium soil by salts carried in solution. (The Anhydrite series rocks are known to produce some saline (sodium chloride) water.) In the inter-arc areas the impermeable nature of the soil, clogged by deposition of clay and silt, restricts leaching, which however occurs on arc sites, where partial hyrolysis of sodium clay occurs consequent on the removal downwards of excess sodium. Thus a deflocculated alkaline soil may be produced in parts of the arc site, and the change of volume which results from loss of structure when wet may produce the potholes observed.

Soil erosion

The question of soil erosion in Somaliland Protectorate is a somewhat vexed one. However, it seems open to doubt whether areas of dead trees in the Protectorate are solely or mainly due to artificial causes, when it is realized that the irregular rainfall in some parts is barely sufficient to sustain tree growth. A sequence of poor rainfall years such as may well occur at intervals, would produce conditions of intolerable drought especially on soils of appreciable clay content. It may also be remarked that the very considerable thickness of clay in several areas probably indicates a previous period of greater rainfall than at present.

The writer has seen examples of gulley erosion east of Adadleh, between El Afwein and Erigavo, and at Hubera (48° 32′ E. 10° 40′ N.). The impermeable nature of much of the soil surface favours sheet erosion but on the other hand gradients are slight over large areas, and rainfall scant. It seems likely that wind erosion is the more potent factor. Vegetation arcs as efficient agents for the receipt and conservation of moisture point to a method of control. In this connection it would be of interest to know whether the South American mesquite (*Prosopis juliflora*) has been introduced to the Protectorate. This tree has foliage which is reported to be unpalatable to goats except in the earliest stages [14] and conceivably to camels also (*mirabile dictu*!). Its establishment on windblown sandy material trapped by suitable barriers could lead to the development of a vegetation cover in a manner akin to vegetation arcs.

The writer is indebted to Dr. W. A. Macfadyen for his help and informed advice on Somaliland conditions. He also wishes to acknowledge the value of stimulating discussion with his colleague Mr. R. L. Birch, and with Mr. R. G. Miller of the Forest Air Survey Centre.

SUMMARY

The writer has made a study of vegetation arcs in Somaliland Protectorate using vertical aerial photographs with an approximate scale of 1:34,000. Vegetation arcs were observed during a visit to the Protectorate but many of the conclusions need testing on the ground. The formation of vegetation arcs is considered to be due to increased percolation, retention and availability of water in localised bands occurring in otherwise relatively impermeable and droughty soils of comparatively high clay content. Deposition from sheets of run-off water, of organic litter and sandy or coarse silty material leads to sites favourable to plant growth. The arcuate form of vegetation bands arises from deposition around local obstacles and from the natural front of deposition in shallow waterways and complementary ridges. The main factors affecting arc formation are rainfall (amount and distribution) in combination with soil type, and the degree and type of slopes. It is suggested that "water lanes" may be in fact "dry lanes". Vegetation arcs point to a method of control of soil erosion.

REFERENCES

[1] Macfadyen, W. A. (1950), *Nature, Lond.* **165**, p. 121.

[2] Macfadyen, W. A. (1950), *Geogr. J.* **116**, p. 199.

[3] *Ibid.*, p. 199.

[4] *Ibid.*, p. 205.

[5] Smith, J. (1949), 'Distribution of tree species in the Sudan in relation to rainfall and soil texture.' Khartoum: Ministry of Agriculture, Sudan Government (Bulletin No. 4).

[6] *Ibid.*, p. 23.

[7] *Ibid.*, p. 53.

[8] *Ibid.*, Plate 23.

[9] Macfadyen, W. A. (1952), 'Water supply and geology of parts of British Somaliland,' pp. 9–38. London: Crown Agents for the Colonies.

[10] Hunt, J. A. (1951), 'A general survey of the Somaliland Protectorate 1944–1950' (C. D. & W. Scheme, D. 484), p. 55. London: Crown Agents for the Colonies.

[11] *Ibid.*, p. 105.

[12] Macfadyen, W. A. (1950), *Geogr. J.* **116**, p. 205.

[13] *Ibid.* p. 204.

[14] Smith, J. (1949), 'Distribution of tree species in the Sudan in relation to rainfall and soil texture,' p. 57. Khartoum: Ministry of Agriculture, Sudan Government (Bulletin No. 4).

ILLUSTRATIONS

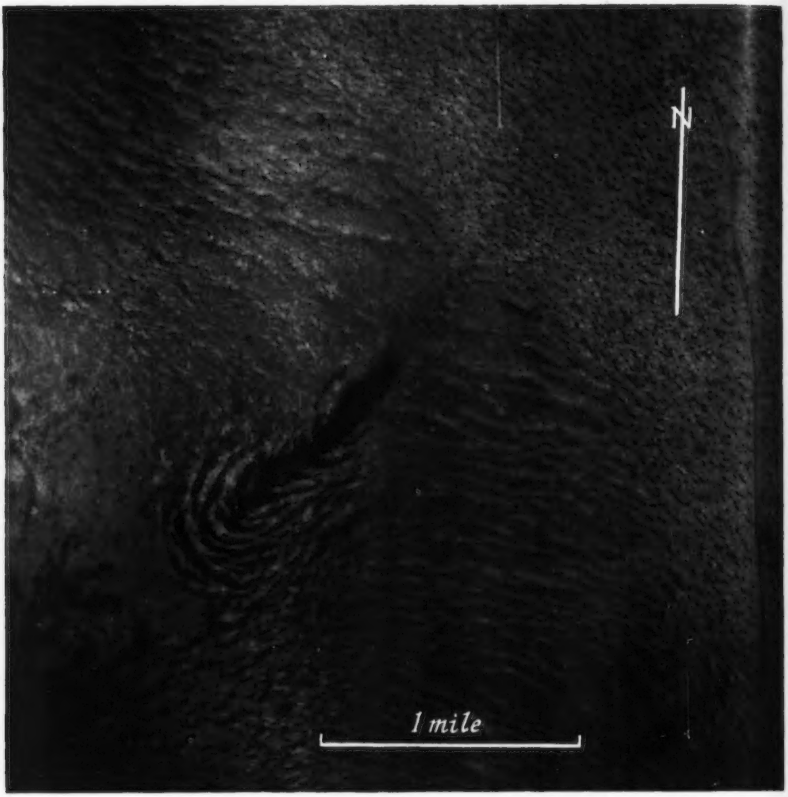
The illustrations facing pp. 468, 469 and pp. 472, 473 for this paper are reproduced from Royal Air Force vertical aerial photographs taken in December 1951 and February 1952. The flying heights were 17,000, 18,000 or 20,000 feet. Most of the photographs have been reduced for illustration.

1. South-east of Las Anod. Confluent trains of vegetation arcs on low ground with surrounding terrain of rounded hills. The higher ground has a fairly uniform cover of tree and bush contrasting with bare lowland carrying vegetation arcs. The light toned accumulated (silty?) material along up-slope edges of arcs is visible. (Short light toned streaks on the uplands are wash from termite mounds).

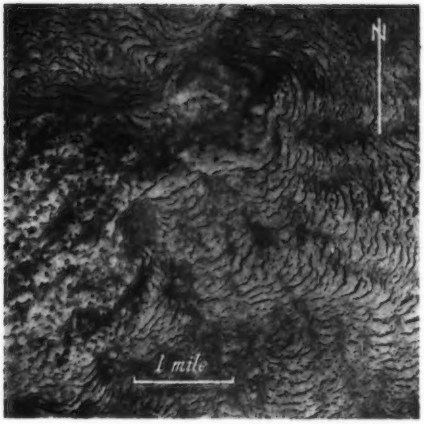
2. South-west of Guled Haji. The arrow shows the general direction of slope. Vegetation arcs on very slightly sloping ground. The curvature of arcs is slight and the form of the arc poorly defined

5 *Crown copyright reserved: R.A.F. photograph*

Vegetation patterns in Somaliland Protectorate (*see pages* 472–3)



6 *Crown copyright reserved: R.A.F. photograph*



7 *Crown copyright reserved: R.A.F. photograph*

Vegetation patterns in Somaliland Protectorate (see pages 472–3)

3. East-north-east of Gardo, Sawl Haud. A ×2 *enlargement of the original aerial photograph, showing vegetation arcs separated by sub-parallel darker toned strips. Stereoscopic examination indicates that these strips are elevated relative to the arc sites; they appear to be ridges complementary to linear depressions in which vegetation arcs form.*

4. A broader view of the terrain of Plate 3. *The boxed area is that shown enlarged in* Plate 3.

5. South-west of Dudwein. The arrow shows the general direction of slope. Vegetation arcs are convex up-slope in the depressions but the overall pattern is convex down-slope on the low broad ridge marked by the arrow. In the latter case, however, individual clumps of vegetation show a generally up-slope convexity.

6. South of Guled Haji. The dark toned strip marks the site of a local depression; here vegetation arcs give way to grass cover. It is considered that accumulation of soil of higher clay content in the depression results in relatively more droughty conditions unfavourable to perennial plant growth. Note the increased curvature of arcs on steeper slopes of the depression compared with adjoining land.

7. East-north-east of Gardo. Vegetation arcs indicating an area of more or less centripetal run-off flow.

ON THE ORIENTATION OF PARABOLIC OR U-DUNES

J. N. JENNINGS

THE METHOD of determining the sand-shifting capacity of the wind, which Bagnold (1951) derived from his experimental studies, called for application to coastal dune analysis as well as to desert dunes. Dr. Landsberg's recent paper in this *Journal* (Landsberg, 1956) gave substantial evidence to demonstrate that her formula based on Bagnold was a more satisfactory means of summating winds for comparison with the direction of coastal parabolic or U-dunes than previous formulae including that of Schou (1945). She found, in fact, a very close correspondence between the resultant of the wind regime in terms of ability to shift sand and the elongation of parabolic dunes in nearly all of a dozen instances from the coasts of Britain and Denmark. The new method supported even more emphatically than its predecessors the thesis that the wind regime is the dominant factor in determining the axial direction of this type of dune.

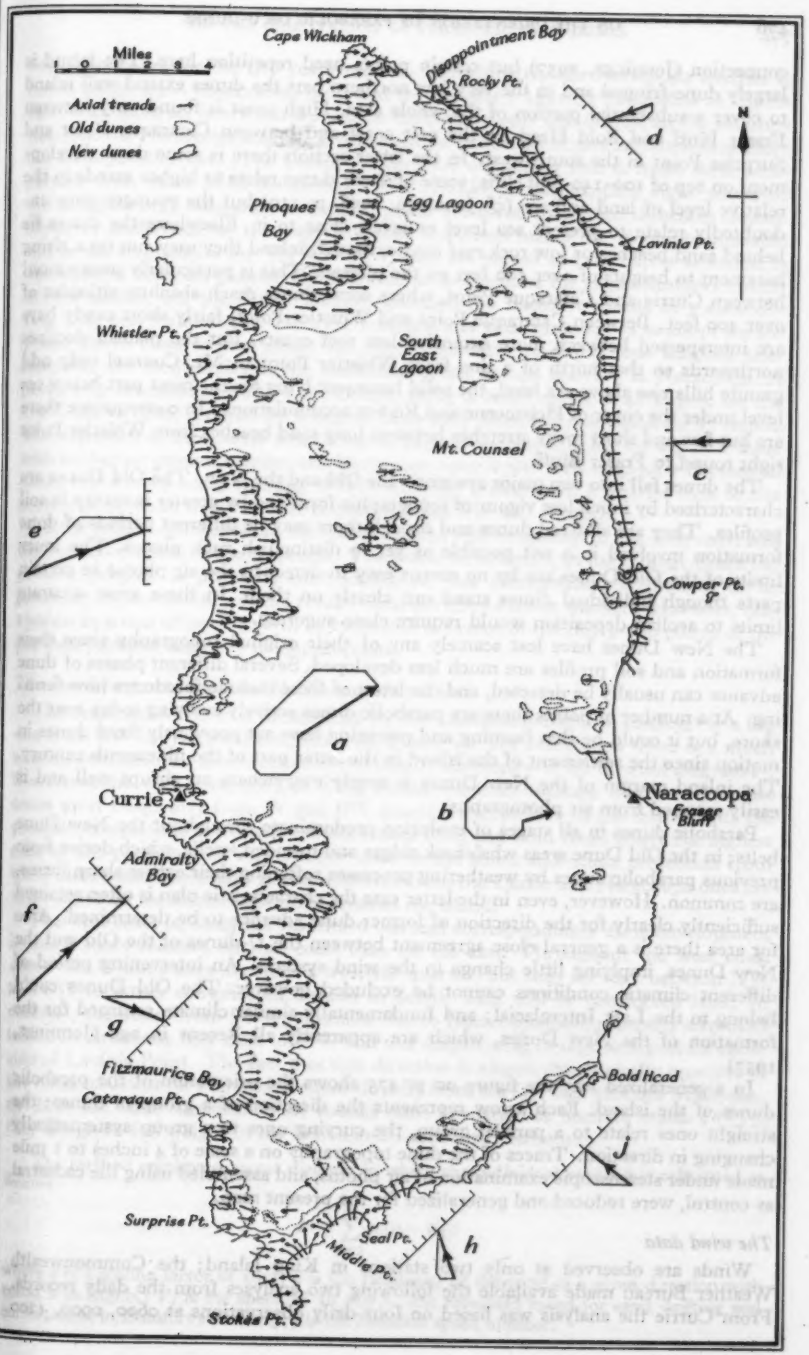
Without impugning the general validity of Dr. Landsberg's findings, problems which the writer has encountered in the study of the dunes of King Island, Tasmania, seem to suggest that in some circumstances the relationship between wind regime and U-dune alignment is not always so straightforward as in her instances, and that on occasions some modification of her method of handling wind data may be desirable. It will be noted that in all her examples the resultant wind direction blows from the sea across the beach which supplies sand for dune construction, even though the angle of incidence of the wind on the shoreline does depart considerably from the perpendicular in some cases. This will be the prevalent condition, of course, since dunes are not so likely to form on a large scale along a shore where there is a comparative absence of strong winds from seaward quarters.

But cases of the latter type do exist and there may be limitations on the applicability of Schou's or Landsberg's methods to these circumstances. Even in deserts this may also be true as Dubief (1952) has noted: "Nous remarquerons qu'il s'agira là de résultats théoriques, car il est bien évident qu'il faut qu'il y ait une source possible de sable à l'origine du transport de ce dernier." In short, onshore winds must play a more vital role in coastal dune evolution than offshore ones. The importance of this point can be demonstrated by an examination of the dunes of King Island where a big "normal" development of dunes on the windward coast is separated by a few miles at the most from a less spectacular but still substantial set of dunes in the lee of the island.

In Dr. Landsberg's paper there is no explicit discussion of the pertinent factor of the disposition of the sand source (*i.e.* the alignment of the sand beaches) in relation to the wind regime. Hartnack (1926) and Van Dieren (1934) have given some attention to this. Thus on Terschelling, as Van Dieren shows, the parabolic dunes of the west coast have WSW–ENE axes, which farther inland become W–E, whereas on the north coast the dunes advance from the NW to begin with and then swing sharply round to the W–E direction inland. The "effective" may thus be very different from the "prevalent" wind even if calculated by Bagnold's formula, though rarely are meteorological stations sited exactly where they are needed for the examination of such questions.

The King Island dunes

King Island presents a more extreme and very interesting example in this problem of the relationship between coastal aspect and wind regime as a factor in dune orientation. The dune systems there have recently been described in this *Journal* in another


Miles
0 1 2 3 4
Axial trends
Old dunes
New dunes
Cape Wickham
Disappointment Bay
Rocky Pt.
N
d
Phoques Bay
Egg Lagoon
Lavinia Pt.
Whistler Pt.
South East Lagoon
Mt. Counsel
c
e
Cowper Pt.
a
Currie
b
Naracoopa
Fraser Bluff
Admiralty Bay
f
g
Fitzmaurice Bay
Cataraqua Pt.
Bold Head
j
Surprise Pt.
Seal Pt.
Middle Pt.
h
Stokes Pt.

connection (Jennings, 1957) but certain points need repetition here. The island is largely dune-fringed and in the very low northern part the dunes extend well inland to cover a substantial portion of the whole area. High coast is found only between Fraser Bluff and Bold Head on the east coast and between Cataraque Point and Surprise Point in the south-west. In the latter section there is some dune development on top of 100–140-foot cliffs; some of these dunes relate to higher stands in the relative level of land and sea (*cf.* Jennings, 1956, p. 110) but the younger ones undoubtedly relate to present sea level or levels close to it. Elsewhere the dunes lie behind sand beaches or low rock reef coasts, though inland they may run up a rising basement to heights of over 200 feet on the plateau. This is particularly pronounced between Currie and Cataraque Point, where some dunes reach absolute altitudes of over 400 feet. Between Cataraque Point and Whistler Point, fairly short sandy bays are interspersed between more extensive low reef coasts. But the plateau declines northwards so that north of a line from Whistler Point to Mt. Counsel only odd granite hills rise above sea level, the solid basement lying for the most part below sea level under the cover of Pleistocene and Recent accumulations. In consequence there are but few and short rocky stretches between long sand beaches from Whistler Point right round to Fraser Bluff.

The dunes fall into two major systems—the Old and the New. The Old Dunes are characterized by much less vigour of topographic form and by greater maturity in soil profiles. They are all fixed dunes and though there may be different periods of dune formation involved it is not possible as yet to distinguish such phases. The inner limits of the Old Dunes are by no means easy to detect in the air photos in certain parts though individual dunes stand out clearly on them. In these areas accurate limits to aeolian deposition would require close augering.

The New Dunes have lost scarcely any of their original topography since their formation and soil profiles are much less developed. Several different phases of dune advance can usually be detected, and the latest of these include foredunes now forming. At a number of points there are parabolic dunes actively evolving today near the shore, but it could be that burning and pasturing have set previously fixed dunes in motion since the settlement of the island in the latter part of the nineteenth century. The inland margin of the New Dunes is nearly everywhere an abrupt wall and is easily mapped from air photographs.

Parabolic dunes in all stages of evolution predominate throughout the New Dune belts; in the Old Dune areas whaleback ridges and rounded swells, which derive from previous parabolic dunes by weathering processes softening their earlier sharp forms, are common. However, even in the latter case the characteristic plan is often retained sufficiently clearly for the direction of former dune advance to be determined. Area for area there is a general close agreement between the U-dunes of the Old and the New Dunes, implying little change in the wind systems. An intervening period of different climatic conditions cannot be excluded however. The Old Dunes could belong to the Last Interglacial; and fundamentally similar climate returned for the formation of the New Dunes, which are apparently all Recent in age (Jennings, 1957).

In a generalized way the figure on p. 475 shows the orientation of the parabolic dunes of the island. Each arrow represents the direction of a group of dunes; the straight ones relate to a parallel group, the curving ones to a group systematically changing in direction. Traces of the dune topography on a scale of 4 inches to 1 mile made under stereoscopic examination of air photos, and assembled using the cadastral as control, were reduced and generalized for the present map.

The wind data

Winds are observed at only two stations in King Island; the Commonwealth Weather Bureau made available the following two analyses from the daily records. From Currie the analysis was based on four daily observations at 0600, 0900, 1200

and 1500 hours for the five years 1940–4. Unfortunately the Naracoopa analysis is based on an 0900 observation only and for the years 1951–5. Resultants at Currie calculated from all hours and from 0900 differed by only one degree, so the assumption that the Naracoopa analysis gives a reliable indication of general conditions there has some justification. (The Currie vectors were divided by four to make them comparable with those from Naracoopa.) The Naracoopa data employ eight points of the compass only whereas the Currie figures are given in sixteen direction classes. Observer preference for the major compass directions makes the 16 points unusable and so the frequencies for NNW, WNW, etc., are halved and the halves allocated to the adjacent compass points. For Naracoopa, frequencies for single Beaufort speeds were available, but the Currie analysis grouped the Beaufort speeds in 5 classes—1–2, 3, 4, 5–6, 7 and above. Here the problem was what mean speed to adopt for the 7 and above class, a very important one. Eventually 45 m.p.h. was adopted after analysing the frequencies in the individual speed groups above 7 at Naracoopa. A previously calculated resultant for Currie, using a mean speed of 40 m.p.h. for the 7 and above class, differed by a degree or so only from the one based on 45 m.p.h. The exposure of the Currie wind vane in 1940–4 was good, being on top of a dune with no higher ground nearby; the Naracoopa vane is also well sited on a flat coastal plain, but a steep scarp running WNW–ESE lies a little over a quarter mile to the southwest so there may be some sheltering from SW and S winds.

In the following discussion, the Currie figures will be applied to the west coast and the Naracoopa ones to the east coast. The island is, however, 40 miles long. Since the present purpose is primarily methodological, this extrapolation is thought to be justified; the consistency of the results obtained gives further warrant. However, discussion in terms of bearings will be eschewed in favour of the thirty-two points of the compass; greater accuracy is inappropriate.

The Landsberg resultants and the U-dune orientation

The resultant for Currie determined by the Landsberg-Bagnold method[1] is a big one from SW by W (wind diagram *a* on Figure 1). For Naracoopa there is a much smaller resultant but the direction is not greatly different—W by S (wind diagram *b*). Conversations with a number of King Island residents indicate that strong winds come most frequently from W and SW quarters everywhere in the island with the possible exception of the coast between Fraser Bluff and Bold Head where the highest part of the plateau rises very steeply close to the shore and offers protection from these directions. Resultants not far removed from the Currie and Naracoopa ones are to be expected for all the sand dune areas of the island.

The west coast is, then, the windward one and correspondingly dune development is much more massive on that coast than on the east. Throughout the west coast dunes the U-dune axes are from a westerly quarter, but they do vary between NW and SW in rather complicated fashion in detail. This will be considered later. In contrast, the dunes from Disappointment Bay to Naracoopa have generally advanced inland in directions very close to E–W and this despite a big change in aspect on either side of Lavinia Point. The fact that this direction is almost diametrically opposed to the wind resultant for Naracoopa stems directly from the fact that offshore winds cannot have the same significance for coastal dune formation as onshore winds and yet they are given full weight in the Schou and Landsberg methods.

[1] The method employs a vector diagram in which the individual vector *b* is calculated as follows:

$$b = s \sum_{j=3}^{12} n_j (v_j - V_t)^3$$

where s is a scaling factor of 10^{-3}; n is the frequency of the wind in a given direction with speed v in m.p.h.; V_t is the speed of 10 m.p.h., the threshold speed for sand drifting and corresponds to Beaufort number 3; j is the Beaufort speed number.

A modified method

1. *Applied to the East Coast Dunes.*—Let us now take the standpoint at the other extreme and determine the resultant of onshore winds only. The general run of the coast from Naracoopa to Lavinia Point is meridional, so that for this stretch the resultant of NE, E and SE winds is required. These three directions have to be taken as representative of an approach arc of 135°; at automatic anemograph stations a wider arc much closer to 180° could be taken. This new resultant (wind diagram *c*) is almost due easterly and the correspondence with the relevant dunes is good. Further round Lavinia Point the NW–SE coastal trend requires by the same method the resultant of N, NE and E winds; this is nearly ENE (wind diagram *d*). Correspondence with the dunes here is not quite so exact but is still satisfactory. It is significant that at a number of points along this coastal sector, the parabolic dunes close to the shore advance from NE or ENE, but farther inland the trend has swung round close to E–W.

Because the beach is the ultimate sand source for Aeolian processes, because the vegetation cover is liable to be less complete on the seaward side (permitting blow-outs to form more readily there), and because storm waves can cooperate there in the origination of fresh wandering U-dunes, onshore winds are likely to play a preponderant part in U-dune development. It is recognized however that to exclude all other winds from the analysis may be almost as misleading as to regard winds from all directions as equally significant in function and to treat them all quantitatively in the same manner. Thus in the instance under discussion it is possible that winds from the west exert an influence on parabolic dunes advancing in opposition from the east coast. If a U-dune advances inland from the N or NE, for example, one of the trailing limbs will offer a partially or completely unvegetated face to the westerly gales and will be liable to be breached. In this situation a U-dune system might fail to develop in anything like an orderly manner. On the other hand a U-dune, which advances from E to W, will not be subject to the same amount of disruption by the strong westerly winds. The latter may move sand backwards down the axial hollow of the parabolic dune but will be much less likely to breach the sidewalls. Therefore it may be that the prevalence of the E–W trend in the east coast dunes is a result not only of the important wind vector from the east but also of their greater possibility of evolutionary continuity in the face of westerly gales.

How winds from opposite directions can work together is illustrated on a smaller scale on King Island. A number of the narrow and partly dune-covered rocky promontories which project from the line of the coast are cut across their base by a big blow-out running straight from the sandy beach of one adjacent bay to the counterpart on the other side. At Rocky Point the alignment of the dune passage is NW–SE; at Bold Head and several other promontories between it and Stokes Point, the directions are around NE–SW. The actual directions in which sand is being moved along these corridors varies with the prevailing weather conditions.

North of Egg Lagoon (see Fig. 1, Jennings, 1957) parabolic Old Dunes from the east coast and the west coast are separated by a gap of less than half a mile. But east of the site of South East Lagoon, they interlock in complex fashion. For this to happen, sea level must have stood at least 50 feet higher, when a big bay extended over the site of the former lagoon; the width of the island here was then reduced from 11 to just over 4 miles. From west and east the dunes advanced perpendicularly to the two shores and in direct opposition to one another.

2. *Applied to the West Coast Dunes.*—Despite the possibility of such additional factors, the quite successful application of this modification of Dr. Landsberg's method to a substantial sector of the King Island coast warrants its extension to other sectors, first of all the west coast. At Currie, the presence of the town and the interference with the landforms involved in its construction makes air photograph study of the dune pattern rather unsatisfactory, but it remains sure that the parabolic dunes near to the observing station have advanced from W or W by S. There is thus a

departure of over 20° from the Currie resultant of all winds, SW by W. Regarding this neighbourhood as having a generally N–S coast, the modified method takes the resultant of the NW, W and SW components only and reduces this departure by half (wind diagram *e*). But not far south of Currie, the coast swings to NW–SE and inland from it (from Admiralty Bay in particular) a SW–NE axial trend is prominent. A resultant based on W, SW and S winds only, the onshore winds for this sector, gives a direction very nearly SW–NE (wind diagram *f*). Farther south the sand beach of Fitzmaurice Bay faces as a whole to the NW; here a resultant of N, NW and W winds is appropriate and gives WNW (wind diagram *g*). In fact, a group of U-dunes does run inland from this bay with trends between NW and WNW. At the southern end of Phoques Bay the situation is analogous; some of the New Dunes here have WNW–ESE axes but this is less obvious in the Old Dunes nearby.

3. *Applied to the South-east Coast Dunes.*—The map shows that with some of the sandy bays of the west coast, better sand suppliers than the rock-reefs between, the parabolic dunes show a slight tendency to be arranged fanwise from the bays concerned. This tendency is more strongly developed on the south-east coast between Stokes Point and Bold Head, where the bays are on the whole more recessed. This point has been noted previously (Jennings, 1957) and it points very obviously to the theme of this note that wind regime must be considered in relation to possible sand sources. The extrapolation of Currie and Naracoopa wind data has already been carried to the extreme; with the high plateau in between, there is even greater danger in applying either to the south-east coast. But when this danger is recognized, there is some advantage in the exercise. Treating it as a SW–NE coast, the appropriate resultant gives SSE from Currie data (wind diagram *h*) and SE by E from Naracoopa data (wind diagram *j*). Dune trends at all consonant with these resultants are only well developed in the New Dunes behind the middle parts of the bays on either side of Seal and Middle Points, and in some of the Old Dunes inland of this sector. The fact emerges that because of a more varied bedrock relief behind this south-east coast, combined with the absence of a strong onshore resultant wind, dune orientation is much more variable in relation to local aspect and topography.

The need for meteorological data gathered specifically in relation to geomorphological problems stands out clearly.[1] The solution lies in self-registering stations (*cf.* Dubief, 1952), but these are costly. But whether the exactly right data from the right place are forthcoming or not, the thesis of this note is that greater flexibility in the handling of wind analyses than is to be found in previous methods is desirable. The approach through resultants may not always be appropriate; the individual action of particular winds and the interaction of their separate results must not be obscured. Dubief has already made this point with respect to desert dunes in the following words: "Il ne faut pas perdre de vue, cependant, que ces résultantes sont la somme géométrique de divers vecteurs qui, bien que pouvant s'annuler géométriquement, n'en réagissent pas moins sur le modelé des dunes."

BIBLIOGRAPHY

Bagnold, R. A. "Sand formations in Southern Arabia." *Geogr. J.* 117 (1951), pp. 77–86.

Dieren, J. W. Van 'Organogene Dünenbildung.' The Hague, 1934.

Dubief, J. "Le vent et le déplacement du sable au Sahara." *Trav. Inst. Recherches Sahariennes*, 8 (1952), pp. 123–64.

Hartnack, W. 'Die Küste Hinterpommerns.' Greifswald, 1925.

Jennings, J. N. "Calc-sinter and dripstone formations in an unusual context." *Aust. J. Sci.* 18 (1956), pp. 107–111.

[1] In comments on the manuscript, for which I am grateful, Mr. J. N. Davies, University of Tasmania, has pointed out that we really need observations of the wind near the ground —the operative wind. With this I agree. What is in fact desirable is a full wind profile.

Jennings, J. N. "Coastal dune lakes as exemplified from King Island, Tasmania." *Geogr. J.* 123 (1957), pp. 54–70.
Landsberg, S. Y. "The orientation of dunes in Britain and Denmark in relation to wind." *Geogr. J.* 122 (1956) pp. 176–89.
Schou, A. 'Det Marine Forland.' Copenhagen, 1945.

APPENDIX

Soil parabolas

Beach sand forms the dunes of King Island but certain small features best termed "soil parabolas" are of different provenance. There are several of these just behind the lip of the south-western cliffs, between two dune lobes. These are low arcuate ridges no more than 5–6 feet high at the most and 50–200 yards in chord length and depth. They enclose small areas stripped of soil, in which the bare rock is exposed and is littered in parts by ironstone gravel. The ridges consist of leached grey-white sand and often rest on an undisturbed podsol profile; some have a shelf in front formed by the iron-humus pan of this profile. The features appear to be due simply to wind erosion of the residual podsol developed on the country rock; the A-horizon provides the sand which has been arrested by the scrub which stretches inland and the illuvial horizon gives rise by break-up and induration on exposure to the ironstone gravel in the denuded central area. From their appearance these "soil parabolas" are of very recent formation, and it seems likely that the wind has been given the opportunity for this soil destruction by the repeated burning of the scrub for pastoral purposes. Usually there are single parabolas arranged side by side behind the cliff top where the wind force is greatest but at one point four of them have telescoped into one another and impounded three small ponds between their rims.

SURVEYING ANEROIDS: THEIR USES AND LIMITATIONS

I. THE METEOROLOGIST'S VIEWPOINT

R. A. HAMILTON

I HAVE BEEN ASKED to speak from the point of view of the meteorologists. Fundamentally, of course, the interpretation of aneroid readings is wholly the job for the meteorologist: I say this in no trade union spirit, but because an aneroid measures atmospheric pressure, a quantity that varies from one place to another, from minute to minute as well as changing with altitude at a variable rate. To be able to convert a pressure into an altitude requires knowledge of the structure of the atmosphere in the area at the time of observation.

Let us take the simplest case, that of a modern explorer—a scientist, perhaps, a geologist or a botanist, who is travelling in unsurveyed country and wishes to determine the altitude of a spot from which he collects a specimen. If he wants to get the best results he should hand over his aneroid readings to a meteorologist for working up, in the same way as the botanist might break off a piece of rock and hand it over to a geologist. In this case the explorer must be prepared to work in any reasonable conditions: he cannot afford to wait for ideal conditions with wind speeds of 6 m./sec. or less—so he will want to know the probable accuracy attained when he makes aneroid measurements in winds of up to 15 m./sec. It is assumed that the explorer has a perfect instrument and we discuss now only the errors arising through our lack of complete knowledge of the state of the atmosphere.

Let us go back to fundamentals and treat this matter as a problem in physics. In order to determine the altitude of a point by measurement of the atmospheric pressure, it is necessary to determine (*a*) the pressure at a second point at a level of known altitude vertically above or below the first point, and (*b*) the temperature profile in the column of air between the two points. The fundamental equation which relates the surveyor to the meteorologist, or height to pressure, is derived from gas laws and the hydrostatic equation.

It is

$$H-H_0 = -\int_0 \frac{RT}{Mg}\frac{dp}{p} \qquad \ldots\ldots\ldots (1)$$

where H, H_0 are the altitudes of the point and of the known level, and at any level, T is the temperature of the air, p is the atmospheric pressure, R is the universal gas constant, M the molecular weight of the air, and g is the acceleration due to gravity. If we take average values of g and M for dry air and define a mean temperature $\overline{T}$ by

$$\int_0 T\frac{dp}{p} = \overline{T}\int_0 \frac{dp}{p} = \overline{T}(\ln p_0 - \ln p)$$

the equation becomes

$$H-H_0 = 67{\cdot}4\,\overline{T}(\log p_0 - \log p) \text{ metres}$$
$$= 221\,\overline{T}\,(\log p_0 - \log p) \text{ feet} \qquad \ldots\ldots (2)$$

where $\overline{T}$ is measured in degrees absolute.

The first physical problem, then, is to determine the pressure at a point of known height above or below the station whose height is to be determined. For this purpose, in low-lying country, it is natural for a meteorologist to turn to a mean sea level pressure chart.

In the British Isles, where conditions are particularly favourable, pressure readings are made hourly over a dense network of stations. To these pressure readings is added a correction for the height of the station read from a table derived from equation (2). This gives what the pressure would be at mean sea level if a hole were dug from the station down to that level. These m.s.l. pressures, together with symbols or figures for other meteorological phenomena, are plotted on a chart for a number of stations which make observations at the same standard times. These synoptic charts are the basic tools with which the meteorologist studies the weather: most forecasting stations plot and analyse these charts every three hours.

To determine the m.s.l. pressure at a certain place at one of the synoptic hours, we will have to interpolate between the isobars on an analysed chart. To what accuracy can this be done?

At pressures of 1000 mb. and temperature 283° A. (50° F.) an error of 1 mb. causes an altitude error of about 8 metres (27 feet). Errors in the m.s.l. pressure are caused by errors of measurement of station level pressure on the mercury barometer, and in the correction to m.s.l. These combined are probably correct to 0·2 to 0·3 mb. (2 metres or 7 feet), but in windy conditions the pressure in the building in which the barometer is situated may be appreciably different from that in the free air outside: in strong winds the error may amount to 5 metres (16 feet). We can get an idea of the errors involved by drawing a chart in which some of the observations are plotted, and then drawing the isobars. The pressures at stations which are not plotted are estimated from the chart and are compared with the actual measurements. I have done this for England and Wales on two recent occasions, 1500Z of 20 December 1956, during the foggy period when an anticyclone covered the area, and 1500Z on 30 December 1956, when an old depression was situated in the Irish Sea and strong winds and gales swept over the area. In each case twenty-one stations are plotted at distances apart of about 100 kilometres.

In the anticyclonic case the standard error of the pressures was about 0·4 mb. (3 metres)—and in the windy case about 0·65 mb. (5 metres).

I have discussed only the measurement of pressure at synoptic hours. At intermediate times the pressure will be not difficult to estimate, except in exceptional circumstances. Over a large part of England pressure measurements are made hourly or half-hourly, and barographs show the rate of change at those and other stations. By examining the pressure records at adjacent stations it should be possible to estimate the pressure at any point with a further error which will not normally exceed 0·2 mb. (2 metres).

Having estimated the m.s.l. pressure the altitude is determined from (2), the altitude being proportional to $\overline{T}$. The value of $\overline{T}$ is about 300, so an error of 1° C. will cause an error of altitude of 0·3 per cent., or an error of 1 metre (3 feet) in altitudes of 300 metres (1000 feet). This is the order of error that is likely in the estimation of the mean temperature of the air column, though in special cases, *e.g.* a very hot day or a very cold inversion, the error may be perhaps three times as large.

These findings can be summarized by stating that the standard error in determining an altitude in England by use of a m.s.l. pressure chart amounts to around 4 metres (13 feet) in anticyclonic conditions, and to about 6 metres (20 feet) in windy conditions.

Now all this is really unpractical, because I said I was going to discuss the case of the explorer in hilly, unsurveyed country, and I have been considering the accuracy achieved when working in a relatively flat country with a dense network of meteorological stations. But it is useful to know what accuracy is achieved in an almost ideal case: we see that even in the ideal case the error due to temperature correction is normally small in comparison with the error due to uncertainty of the pressure field. Only in the anticyclonic case, when perhaps an inversion or strong solar heating may make the evaluation of $\overline{T}$ difficult, is the error in estimating $\overline{T}$ of comparable magnitude: in the windy case it is not likely that any significant error will be made in the estimate of $\overline{T}$.

Of far greater importance are the errors arising from topography—either the distortion of the streamlines of the horizontal air flow by a hill or cape or turbulence caused by rough ground.

Meteorologists know well that m.s.l. pressures from St. Abb's Head or Portland Bill must often be regarded as "spurious." Crossly (*Quart. J.R. met. Soc.* 64 (1938), p. 477) has shown that the apparent error is due to the increased velocity of the air as it blows past the obstacle so that the tangential acceleration of the air cannot be omitted from the equations of motion. The effect is negligible in low wind-speeds, but increases with wind-speed, and amounts to 1·13 mb. (10 metres) if a normal wind-flow of 12 m./sec. is increased to 19 m./sec. as the air flows past the obstacle. Lee (*Met. Mag., Lond.*, 77 (1948), p. 201) has investigated the anomalies of pressure at St. Abb's Head and found that in nearly 30 per cent. of occasions the anomaly exceeded 1 mb. (8 metres) and on 8 per cent. of the occasions it exceeded 2 mb. (16 metres); the anomaly increased with the wind speed but became appreciable only when the wind exceeded 8 m./sec.

These geographical features cause an anomaly of constant magnitude and sign so long as the wind speed and direction does not alter. Of equal or greater importance are the fluctuations of pressure due to turbulence in hilly districts. Scorer (*Weather*, 8 (1953), p. 343) has drawn attention to fluctuations of around 1 mb. (8 metres) on the trace of a barograph in a valley in the Lake District, in unstable conditions and winds of gale force. There are reports of very much larger pressure fluctuations on high mountains in America, but these occur in such high winds that no scientist would be at work, and so we need not be concerned.

An interesting direct investigation of altimeter errors near mountains was made by Scorer and a team from Imperial College, in North Wales. Simultaneous readings were taken of an altimeter in a glider and of its altitude by double theodolite method. It was found that the standard error was around 5 metres for wind-speeds of less than 10 m./sec. but rose with increasing wind-speed and was more like 20 metres in unstable conditions with wind-speeds of nearly 20 m./sec. These observations were made at quite a low level—400–800 metres—and, it should perhaps be emphasized, were made in the free air where perhaps anomalies due to turbulence and standing waves are probably larger than would be experienced by an explorer actually standing on a mountain itself.

An estimate of the standard error of aneroid measurements of altitudes around 1000 metres in England, with its good network of meteorological stations, is about 4 metres for winds less than 6 m./sec. rising to around 15 metres for wind-speeds of 15 m./sec. In more rugged country, or in an area where there are only a few meteorological stations, the standard error at low wind-speeds will be considerably larger, though the error at greater wind-speeds may not be appreciably increased. In the tropics, though meteorological stations may be farther apart, pressure changes are smaller and the diurnal variation is more regular, so better accuracy will be attained.

The advantage of using m.s.l. charts is that there is a large number of stations with barometers from which the m.s.l. can be estimated. But there is the practical as well as the academic difficulty of estimating the mean temperature of a non-existent column of air because, of course, there is no air literally between the station and m.s.l. In low-lying country the error introduced by assuming as estimated mean temperature is small—0·3 per cent. per ° C.—but at greater altitudes the error becomes excessively large, both because of its proportionality to height, and because the imagination of a column of air with a mean temperature can no longer be tolerated.

On higher ground, therefore, we must choose a higher level at which to estimate the pressure (though in actual fact we do the converse, we estimate the altitude at which the pressure is a standard value). We use equation (2), but now $H<H_0$ and $p>p_0$, and $\overline{T}$ is the mean temperature of the actual air column between the station and the standard level. Perhaps I should outline briefly how upper-air meteorological charts are constructed. From radio-sonde stations at certain times a balloon is

released which carries a small instrument which measures pressure, temperature and humidity and transmits this information by radio to a receiver on the ground. From this information the pressure at any altitude can be computed from equation (1), or by using equation (2) over finite steps of 1000 metres or so. In this way the altitude at which the pressure falls to certain standard values is determined. In addition the balloon is followed by radar so that the wind at different levels can be measured, as well as the distance and elevation of the instruments so that an independent check of the altitude of pressure levels can be made.

The standard pressure surfaces whose altitudes are computed are 850, 700, 600, 500, 400, 300 mb. at approximately 1500, 3000, 4000, 5500, 7000, 8500 metres.

For surveying purposes the meteorologist will choose the lowest standard pressure level whose value is generally less than the pressures measured by the aneroid. The general thermal structure of the atmosphere is given by the radio-sondes and knowledge of this, and actual air temperature measurements made by the surveyor, enable the meteorologist to determine the mean temperature of the real air column between the surveyor and the chosen standard pressure surface.

The disadvantages of using upper air charts—and I must emphasize that you cannot use m.s.l. charts if you are surveying at altitudes much in excess of 1000 metres—is that the network of stations is comparatively sparse: even in the British Isles there are only nine stations. Contour lines of the isobaric surfaces are drawn at 60-metre (200-foot) intervals.

Moreover, temperature soundings are made only at twelve-hour intervals. So, when we wish to estimate the height on the isobaric surface vertically above the aneroid we may have to make quite a large interpolation both for space and time.

The accuracy achieved will again depend on the locality—*i.e.* on the density of upper air stations, on the magnitude of the changes that take place, and on the altitude—in general the higher the level the larger the error. As an example, perhaps I can just refer you to the use I made of the 700 mb. charts over North Greenland in determining the altitude of aneroid stations on the inland ice (*Geogr. J.* **122** (1956), p. 225). The standard error in the determination of a 700 mb. altitude by radio-sonde is around 5 metres. In this case, in addition to the radio-sonde stations round the coast of Greenland, we had a fixed station "Northice," about 200 kilometres from the aneroid stations and at approximately the same altitude, equipped with mercury barometers, barograph, thermometer and thermograph. The standard error of the altitudes of the aneroid station at altitudes of around 2700 metres (9000 feet), relative to "Northice," was estimated to be about 8·5 metres or 13 metres relative to m.s.l. This may seem rather large but survey of any type on the Greenland ice sheet is difficult and the standard error of the altitude of "Northice" was 10 metres.

I have been trying to point out what are the fundamental physical processes involved in measuring altitudes by aneroid. Most of you present will understand and appreciate these, and my concluding remarks are addressed to what may amount to a band of explorers and climbers who tread unexplored country and bring back aneroid readings which are quite useless; and who miss thereby the chance of doing useful work. The appeal consists of asking you to follow these instructions:

1. Enter all aneroid readings in a notebook with the time and date.
2. Read the actual pressure reading (and may manufacturers calibrate aneroids in millibars, not inches!), and not any spurious height reading.
3. With every pressure reading, note the air temperature—properly with a whirling thermometer or psychrometer—and the wind.
4. If a halt is made at a point, take as many aneroid readings as possible, particularly an evening and morning one if a night stop is made. If possible, take the readings at 00, 03, 06 . . . 21 hours GMT, and make temperature and wind measurements at the same time.
5. Arrange whenever possible for simultaneous pressure temperature and wind

measurements, or a continuous record of these elements to be made at a base or camp as near as possible to the surveyor in position and altitude.

I will conclude by drawing the attention of the specialist to two points I have glossed over.

(*a*) While equation (1) is strictly true, except when there are accelerations, equation (2) is not, because the humidity of the air has been neglected. At higher temperatures and humidities this should be taken into account and the appropriate values of M for the moist air at different levels should be used.

(*b*) On meteorological charts altitudes are expressed in geodynamic metres, so altitudes taken from them are also in these units. To convert to geometric units the geodynamic altitude is multiplied by the factor 980/g, where g is in cm./sec.^{2} Generally this is negligible.

A discussion such as this should perhaps be followed by suggestions for research, and I would like to point out that there are now several manned radio stations in the U.K. on mountain tops around 800 metres high: we could perhaps have pressure readings made there, and from these get an idea of the accuracy of determinations of altitude by pressure measurements in different meteorological conditions.

II. THE LAND SURVEYOR'S VIEWPOINT

C. A. BIDDLE

The existing text-books all emphasize the difficulties of dealing with aneroids of obsolete design, and give poor figures for performance. Strictly, the land surveyor's instrument should be called an altimeter, not an aneroid, since it will normally be graduated in feet or metres, not in inches of mercury. Graduation in height can only be carried out if certain laws are assumed; a further discouragement to the practical surveyor has been the highly scientific arguments as to whether the graduation should assume a uniform air temperature—the isothermal law; or allow for the fall in temperature with height—the lapse rate law. The latter may be more useful where temperature corrections are not applied—as with the aircraft altimeter—but the land surveyor will apply them anyway, and all survey altimeters are isothermally calibrated. Not that this matters in the least to the user; provided he has the makers' instructions for corrections for air temperature, and possibly humidity also, he need know nothing of graduation formulae.

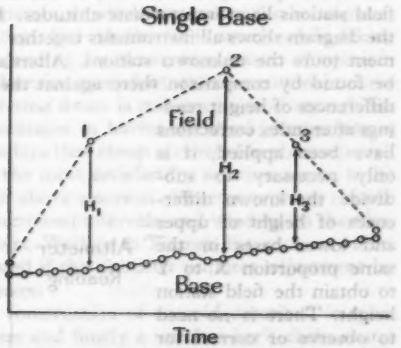


Figure 1

There are certain standard methods of procedure for field work, all of which take into account the change of pressure, and hence of recorded height, with time at a fixed station. A better result is obtainable if sufficient data are available to deduce the slope of the plane of uniform pressure, and hence to allow for any departure from the horizontal.

The usual text-book method is the single base (Fig. 1). Here one instrument

remains at a base station, usually, but not essentially, at a point of known height, and its readings are taken by an observer say every five minutes, or recorded automatically. From a graph of base readings against time, the base reading appropriate to any intermediate instant can then be interpolated. The field observer carefully compares his altimeter against the base altimeter, to obtain its index error, and then visits in turn stations 1, 2, 3 of unknown height, noting times and altimeter readings at each; finally closing back at the base station. The differences of field and base height readings H_1 H_2 H_3, corrected for index error and with a further correction factor applied for air column temperature, give the difference of height of base and field station; if any one height is known, the rest can be computed.

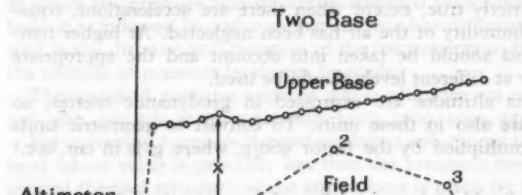


Figure 2

In the two-base method (Fig. 2) control readings are taken, say every five minutes, at base stations preferably so sited that all unknown field stations lie at intermediate altitudes. Relative index errors must be found, and the diagram shows all instruments together at the lower base, before the field instrument tours the unknown stations. Alternatively the upper base index error might be found by comparison there against the field instrument. If X and Y represent differences of height readings after index corrections have been applied, it is only necessary to subdivide the known differences of height of upper and lower bases in the same proportion X to Y to obtain the field station height. There is no need to observe or correct for air temperature; and there is some compensation for the slope of the plane of uniform pressure, along the line of the bases. If three or more base stations are used, it is possible to compute the slope of this plane in any direction, and thus correct for the position of the field station. An ideal layout with sufficient base observers, or with automatic recording, would be three or four low base stations, enclosing the area for work, with one high station near its centre.

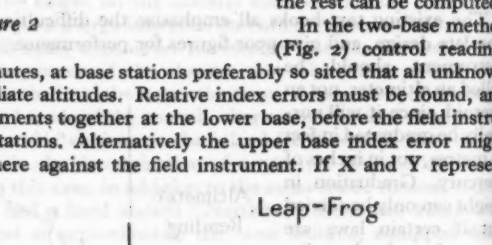


Figure 3

The leap-frog method has been very favourably reported on from overseas. Here (Fig. 3) we have two instruments, starting together at a known height. A stays there

to take five-minute readings until his companion B has had time to reach his first field station. B remains there to take five-minute readings, while A leap-frogs to the second field station, where he in turn takes five-minute readings until B joins him; the whole procedure is then repeated until a station of known height is reached on which to close. The height differences of successive field stations can then be computed, after corrections have been applied for air temperature. Time will obviously be saved if means of communication between the observers are provided; walkie-talkie sets seem indicated. If the casual errors of instrument reading were considerable, it would seem very doubtful practice to determine a large height difference by summing up a large number of measured small differences in this way. From the results claimed, it seems that the short distances between successive base and field stations, and the closer readings of air temperatures more than counterbalance this.

Lastly, there is the method applicable in the tropics only where a mean value of the daily altimeter reading, or diurnal wave, is obtained over a number of fine days, and treated as if it were the actual base record. This method is of limited accuracy only, even in fine weather; outside the tropics, or in unsettled weather, it is quite useless.

There will always remain errors due to casual pressure changes not being simultaneous at base and field stations; these can be minimized by working in fine weather, when pressures are steady, and at limited distances from bases, the latter preferably selected in the middle of the area for survey, and not separated from any parts of it by hill ranges. For exploration work, especially over great height differences, meteorological uncertainties will swamp instrumental errors, and the most precise instrument may not be worth while. The land surveyor always avoids big height differences; for his more usual task of filling in gaps between heights already fixed by triangulation, it is worth while reducing instrumental errors to a minimum.

Modern altimeters seem to be very nearly free from hysteresis and drift, except possibly when subject to rapid pressure variation, as when they are used in helicopters; this incidentally is a practicable proposition, but whether it is worth while taking readings while hovering, as opposed to landing for them, is a matter of opinion. Altimeters can now be obtained with graduations every foot; the conventional micro-barograph with a pen recording on a rotating drum is not nearly good enough for work with them. There are obvious advantages in having identical instruments at field and base stations. It is seldom nowadays that cheap and reliable observers will be available for manning base stations; the most satisfactory solution seems to be photo-recording, a camera being mounted above a normal altimeter, with an electric mechanism making an exposure at predetermined intervals, and winding on the film, on the same lines as an air camera. Messrs. Wallace & Tiernan list such an outfit. The advantage of photo-recording is wasted if the altimeter requires adjustment by an operator, and this rules out several makes.

The tendency now is to abandon the construction of aneroid described in most text-books, using several pin-jointed levers and finally a watchmaker's chain round the pointer spindle. To read to 1 foot, a high degree of magnification is necessary, since the corresponding capsule movement may only amount to about 1/100,000 inch. An anti-parallax mirror seems very desirable, together with a fine pointer. A vernier scale is sometimes used, but would not appear very satisfactory, as it introduces an additional complication, the necessity that the scale shall be uniform throughout its length. This is not a natural condition, and would seem to introduce calibration difficulties.

One original design is the Paulin, introduced in Sweden, and still made there; but an American Paulin firm is also producing instruments of the same type, including micro-altimeters graduated to 1 foot. In all Paulin instruments the capsule is to be prevented from expanding with change of pressure, the operator varying the applied force which resists collapse of the capsule. This force is recorded on the dial, which thus gives a measure of the altitude; it is adjusted until a small pointer stands at its zero position to indicate that the capsule is unexpanded. Photo-recording with a

Paulin is no advantage; but the American firm offer a recording micro-altimeter of similar accuracy, in which the small pointer has to be kept continuously central by the operator.

An instrument altogether new to this country is the Askania, made in Germany with the capsule in the form of a long helical Bourdon tube. This twists a mirror, and thereby displaces the image of a pointer relative to a fixed scale. The instruments are not cheap—about £175—and delivery is difficult, but they claim a standard of accuracy better than that of any other instrument now available: over small height differences an uncertainty of about 0·4 foot. The range of the instrument is wide—one model up to about 10,000 feet divided into fifteen overlapping sub-ranges. Photo-recording would be possible over any single sub-range, but Askania also supply a rather complicated micro-barograph of similar accuracy, incorporating a photo-electric cell controlling the marking mechanism. It seems likely we shall hear a lot more of these instruments.

A very popular model is the American Wallace & Tiernan, of which the most precise model reads to 1 foot. The mechanism is very simple, a long lever having its fulcrum very close to the point of contact with the capsule. At the other end of the lever is a rack, engaging a small pinion on the pointer spindle. The scale of these instruments shows curious irregularities, which became the subject of research at University College London. We were not satisfied with the firm's explanation that these necessarily resulted from individual calibration every 100 feet, and we proved they were due to poor gear design; the individual calibration serving chiefly to compensate (in part) for the sine wave caused by the failure to use involute teeth. This is not to say that the instruments are not good; they are well within their guaranteed accuracy of 0·1 per cent. of their range, but with a little more care in design they could have been very much better, and probably cheaper as well, since less calibration would have been necessary. Messrs. Wallace & Tiernan are now redesigning, and the performance of their new models, due shortly, should be very interesting. I have already referred to their photo-recorder. It seems regrettable that this field does not seem to have attracted new British designs since the war. The accuracy of these modern instruments depends so much on circumstances—distances from base, height range, weather, etc.—that it is hard to give useful figures. Working from multiple bases over a 5-mile square, with a 500-foot height range, I should hope to have a probable error of less than 2 feet in a height. It is quite practicable over small areas to contour on large scales by altimeter, but it is obviously less accurate than by level, and the larger the scale, the less the advantage in time; although practicable, it may not be economical. I should applaud the practical student, who was asked how he would find the height of a building by aneroid, and replied, "Let it down on a string, then measure the string."

III. THE GEOMORPHOLOGIST'S VIEWPOINT

B. W. SPARKS

Although some geomorphological investigations must be pursued with accurate surveying methods, there are other problems, such as the mapping of dissected marine and river terraces, which may be approached with less precise methods. Attempts to define the altitudinal limits of such features to the nearest foot are unnecessary, partly because such features have been subject to considerable and probably variable erosion and partly because it is virtually impossible to locate their limits exactly in the field. On the other hand, suggested terrace sequences are most convincing when they are demonstrated over large areas, so that a surveying method which enables a large area to be covered is desirable. Further, it is better if such a surveying method can be operated by one man, as it will then be more generally useful.

The aneroid immediately suggests itself, because of the speed with which the instrument can be used. But the aneroid is suspect, largely because of the size of the errors introduced by variations of general atmospheric pressure. However, if traverses of one hour or less are made between points of known elevation, such as trigonometrical stations and bench marks, and the closing error distributed between the readings on the assumption that pressure change has been constant, it seems that errors of no more than ± 5 feet need be made in the right meteorological situations.

Suitable meteorological situations

(*a*) *Anticyclonic conditions.*—The maximum errors occur when the diurnal peak or trough is straddled by traverses, but they do not appear to exceed 5 feet.

(*b*) *Large rises and falls of pressure.*—These occur ahead of and behind fronts. If the fronts are weak, the winds may not be so strong as to forbid surveying (see below). In general, the errors tend to be smaller than those associated with anticyclonic conditions.

Unsuitable meteorological situations

(*a*) *Fronts.*—The errors are large and increase steadily with the duration of the traverse.

(*b*) *Unstable weather conditions.*—There are considerable fluctuations of pressure in very unstable conditions, so that the errors after correction are too large, although they do not increase necessarily with the length of traverse, as when fronts are straddled by traverses.

(*c*) *Irregular development or movement of pressure systems.*—The resulting pressure fluctuations resemble those in unstable conditions and the errors are consequently similar.

(*d*) *Wind.*—The difference in apparent elevation facing the wind and back to the wind, the increase in the latter position being due to the reduction of pressure in the eddy in the lee of the body, increases approximately with the square of the wind speed. It thus seems undesirable to use an aneroid in winds exceeding approximately 12 m.p.h. As a turbulent flow over irregular relief must lead to similar effects, it would seem to be unwise to trust any readings in such conditions.

Although many days must be excluded because of unsuitable weather, aneroid surveying of the type outlined above can be undertaken on about one day in two in south-east England and about one day in four in north-west Scotland, the percentage of suitable days being obviously somewhat higher in summer than in winter. Even if a considerable number of observations have to be repeated, the method is still more rapid than most others of comparable accuracy.

My own experience has been with 5-inch surveying aneroids reading to 1 foot with a vernier. Such instruments should have a mirror for eliminating parallax and as sensitive a response to pressure changes as possible. Aneroids seem to vary in the degree to which the needle "sticks." Ideally, it would be desirable for the instrument to give the same reading whether held in a vertical or horizontal position.

(Summary of a paper on "The effects of weather on the determination of heights by aneroid barometer in Great Britain," published in the *Geographical Journal*, 119 (1953) pp. 73–80.)

DISCUSSION

Afternoon Meeting, 4 February 1957

Before the paper the CHAIRMAN (Professor E. H. THOMPSON) said: The subject of "Surveying aneroids: uses and limitations" is becoming more and more important to surveyors. The advent of the air photograph has reduced considerably,

particularly for topographical mapping, the amount of minor triangulation that is required. As a consequence, one is deprived of this means of carrying heights across undeveloped country. On the other hand, the provision of heights is as important as it always was because, for various reasons which do not concern us this afternoon, it is rather more difficult to carry heights forward using air photographs than it is to plan positions. In the absence of triangulation one needs a method of determining heights which is independent of any chain between the datum station and the point; and the aneroid is one obvious solution of the problem. In another direction one can improve considerably the heights obtained from aerial photographs if one knows the difference of height between successive air stations in a strip of photographs; and for this the aneroid, used in a different way in the aeroplane, is very useful. I personally cannot foresee these two uses disappearing in the near future; we are thus at a stage at which we wish more and more to put the aneroid to extremely accurate use, whereas in the past the surface uses of the aneroid, being limited for practical purposes to exploration, did not necessitate great precision.

A great deal has been done in the past few years on instruments, and on methods for improving heights from aneroids, and I hope we are about to hear something of that work this afternoon.

Three speakers are here to introduce the discussion. Mr. Sparks is a lecturer from the Department of Geography at Cambridge; he will summarize the results of his research into "The effects of weather on the determination of heights by aneroid barometer in Great Britain." Mr. Hamilton, who is an Air Ministry meteorologist, attached to Prestwick Airport, was Chief Scientist on the British North Greenland Expedition, 1952–54, during which time he concerned himself with the problem of obtaining accurate heights for the ice cap. Lieutenant-Colonel Biddle is lecturer in surveying at University College London, where he has spent a considerable part of his time investigating instrumental accuracies and errors and developing practical field procedures.

Mr. R. A. Hamilton, Lieutenant-Colonel Biddle and Mr. B. W. Sparks read their papers

The CHAIRMAN opened the subject to general discussion.

Professor P. A. SHEPPARD (Department of Meteorology, Imperial College): I think the problem wants breaking down into two aspects. The aneroid, as we all know, may be a poor absolute instrument, but it can be a good instrument for relative values. The problem before the meeting is essentially the problem of getting good relative values, because the problem of getting values put against an absolute scale is something we do not, in general, use the aneroid for. The next point is this: What accuracy is to be sought in the field from aneroid measurements? I suggest that, if the desirable accuracy is the nearest 10 feet, then the problem is primarily a meteorological problem rather than a problem in the aneroid itself. My feeling is that a good deal that Colonel Biddle told us was not very relevant to the problem because he was talking of errors which will, generally speaking, be swamped by meteorological errors unless a considerable effort is made to eliminate them.

Here all I wish to do is to underline the implications of Mr. Hamilton's remarks that the undoubted requirement is to make the maximum use of all that the relevant meteorological services of the world can provide to determine the corrections to aneroid observations. Thus, error curves such as Mr. Hamilton showed for particular situations are, generally speaking, available from any meteorological service for particular occasions to a relative accuracy of the order of 10 feet. I may be a little optimistic here for some parts of the world, but, after all, a great deal of what has been discussed this afternoon is concerned with places which are not completely "off the map." If, then, you are aiming to get 10-feet accuracy the aneroid would meet your problem provided you use it with all due attention to the checks which have been spoken about. You have really got to make use of the meteorological information which will be available through meteorological services in order to get the time

corrections, the space corrections, and so forth, which are necessary in order to achieve that accuracy of 10 feet. To get inside an error of 10 feet is a problem on the aneroid itself, but I doubt whether in general it would be justified unless you were working under conditions where meteorological factors will not be of any consequence, and I doubt whether that is often true.

Brigadier H. A. L. SHEWELL: There seems to be a danger in this affair of concentrating too much on the trees at the expense of the shape of the wood. I support the last speaker in that I think if you congratulate yourself because your aneroid is accurate to 0·4 of a foot you may be in a fool's paradise. I fail to see the good of measuring pressure differences so accurately when the wind and other meteorological variations upset the pressure-height relation to a much greater degree. If, as we have heard, meteorological conditions produce such anomalies in this country, how much more will it be so in the places surveyors generally find themselves, where the nearest meteorological station is 500 miles away?

Another point is that until recently it was generally considered to be better to read the pressure scale and reduce the pressure difference by the formulae, than to use the height scale and try to correct it for departure from a set of ideal conditions whose exact nature was unknown. Most text-books recommend the pressure scale for the most accurate work. As one speaker remarked, most height scales provided by makers on their instruments contain some allowance for what they call average humidity but, in my experience, one seldom knows what that allowance is. So, if you want to correct your height scale readings for the actual humidity, you don't know by how much to correct your correction for the correction that has already been made. Of course, you also need to know the temperature for which the height scale has been calculated, but you can find out fairly easily by taking corresponding height and pressure readings at two widely spaced points and using them to derive T from the fundamental Laplace formula.

No doubt, if you have a nice new modern instrument, complete with maker's instructions and charts, you can correct height scale readings successfully but, in the days when I went around with a barometer, I always had to work with one about which I had no information; and I think the majority of the surveyors in this hall have had to do the same—and most will again. I think that in such conditions the two-base method must have great advantages because it needs no correction for the temperature and humidity. I feel fairly certain that with anything but the finest instrument the two-base ought to be superior to the leap-frog method. I was very surprised to learn that, on a recent test in East Africa, the leap-frog method seemed to be more accurate. I think that shows two things: first, that meteorological irregularities of the atmosphere upset the assumption of a linear law between the two bases of the two-base method and, secondly, that the leap-frog method gains by keeping the two instruments always so close together that the effects of the atmospheric irregularities are eliminated. In the leap-frog method I would expect the summation of so many differences, each with its own small error, to build up to an appreciable overall error. It may well be that for this method, far more than for any other, a really sensitive instrument, capable of detecting changes of a foot, or less, would have greater advantages than I was prepared to admit when I began. There is one question I would like to ask about the leap-frog method. In the kind of rough bush country in which aneroid heighting is usually done, how can you synchronize the A and B readings? The only reliable way I can think of is by means of walkie-talkie sets. If so, it will tend to limit the use of the method as they may not be available or may go out of order. Or is there some other way of synchronization?

Lieutenant-Colonel BIDDLE: The answer to the synchronization problem is the walkie-talkie set.

The CHAIRMAN: I think the field work referred to was done in Africa under the United Nations, where I imagine money for walkie-talkie sets was available.

Dr. S. H. SHAW (Overseas Geological Survey): I had not expected to speak in this

discussion, but since the Chairman has asked me to do so I should like to make a plea for the continuance of efforts to improve the performance and accuracy of surveying aneroids. I do this from the point of view of the geologist-geophysicist interested in gravity surveys. Although there is no escape from the slow and tedious method of levelling where the highest accuracy is required, there are many cases where general reconnaissance information of value could be obtained if one could measure rapidly, within reasonable limits, say ± 5 feet but with a probability of greater accuracy, the heights of a considerable number of gravity stations. This problem is of greater importance now that such quickly operated instruments as the Worden gravimeter are available for obtaining the gravity readings. What the geophysicist needs in this respect is not a guarantee that each height reading he obtains will be exact, but that in ordinary conditions and closing on a fixed base station it will normally show the variation in height from that of the base station within the stated limits. Knowing the possibility of occasional greater error he can make his own allowance for possible anomalies in his reduced gravity readings resulting from errors in heighting.

The CHAIRMAN: I think there are two distinct problems involved and they are, to some extent, being confused. Although it has been mentioned that the problem is one of the determination of *relative* height, in fact I think there are two problems, one of which is more or less the determination of *absolute* height. If you are going to work a long way from base with a big difference in altitude, that becomes a determination of absolute height. The kind of problem Colonel Biddle was talking about, and the kind of problem Dr. Shaw has mentioned, is essentially a problem of interpolation between known heights. In the first problem it is obvious that meteorological considerations are the prime and most important ones. In the second problem it seems to me clear that unless the distances are very large the instrument is the prime consideration, and I cannot help feeling that it would be a mistake if the effort to improve the accuracy of the instruments was in fact relaxed. My own feeling is that, with recording instruments, there is no reason why one should not have in an area 10 miles by 10 miles, or something of that order, a minimum of four recording stations, which is what is required for linear interpolation in all three dimensions. If there are four stations recording pressures continuously one can deduce a pressure gradient in plan and elevation; and, without any outside meteorological information, it should be possible to arrive at a very good idea, by interpolation, of the pressure at any point. We have not yet heard anything about the use of altimeters in aircraft which interests us very much from the point of view of surveying with air photographs. Mr. Honick is here from the Royal Aircraft Establishment, Farnborough. Would he like to add a word, possibly on that?

Mr. K. R. HONICK (Royal Aircraft Establishment, Farnborough) said that having been concerned for some years with the barometric measurement of aircraft height, he had been impressed to hear of surveying aneroids graduated in 1-foot intervals. It was important, however, to distinguish between sensitivity and absolute accuracy. He was of the opinion that, due to instrumental limitations and meteorological uncertainties in the knowledge of temperature and temperature distribution with height, the best order of absolute accuracy they could achieve was within about $\frac{1}{2}$ millibar (15 feet at sea level). He would also support very strongly the speaker who advocated working in terms of pressure scales. If, in fact (as he thought Colonel Biddle had said), temperature corrections were invariably going to be made, there appeared to be little point in graduating in terms of any assumed height-pressure relationship except for very short interval relative observations. The reduction of readings was greatly facilitated by working in pressure units and of these the millibar was the preferred unit.

In reviewing new developments, Colonel Biddle had regretted that no British examples were included. In defence of the British instrument industry, he would like to draw attention to an instrument of novel type now being made by Mechanism

Ltd. of Croydon. This operated on the displacement principle in which an aneroid capsule was allowed to deflect freely without any load being imposed on it by the operation of a linkage or pointer. The deflection with pressure variation was linear over the range covered and the position of the capsule was determined by a micrometer screw head similar to the normal measuring micrometer, but graduated directly in millibars. The screw advanced an electrical contact to make with another on the capsule. Consistency of contact pressure was achieved by the use of a small tuning indicator popularly known as a "Magic Eye," the power for which was provided by a miniature hearing-aid battery. The instrument was robust and portable; it was shown in 1956 at the Society of British Aircraft Constructors' Exhibition and the accuracy claimed for it was, he thought, of the order of 0·1 to 0·2 millibars.

So far as the barometric measurement of height in aircraft was concerned, the problems were the same as those outlined by earlier speakers. A knowledge of the complete temperature structure of the air from the ground upwards was ideally required for correction purposes.

The CHAIRMAN: Although absolute height in surveying from air photographs, if accurate, would be valuable, I do not think that at the kind of heights at which one would normally fly for this work (that is to say, 15,000 up to 25,000 feet for work in peace-time and higher for military purposes) there is any chance of getting a height sufficiently accurate by using an aneroid. But what is very valuable to us is to get the difference in height between two exposure stations. Thus we are not so much concerned with the problem of absolute differences of height of the order of 20,000 feet as with a difference of height accurate to within a foot or two over, perhaps, 100 or 200 feet and in a relatively short interval of time between air stations.

Dr. RONALD FRITH (Meteorological Office, Air Ministry, Harrow): Mr. Honick has to a certain extent stolen my thunder because I had hoped to introduce the Croydon aneroid to the meeting. The makers do not yet know what the accuracy of the instrument will be; the figure 0·1 millibar, mentioned by Mr. Honick, refers, not to the absolute accuracy, but to the repeatability on a given occasion and at a constant temperature. This business about temperature errors has not been mentioned by anyone so far and I am rather surprised. Most aneroids are supposed to be temperature compensated but the compensation is never perfect and when very high accuracy is needed, this can be a serious source of error. The Meteorological Office have placed a development contract for the incorporation of a temperature compensation in this instrument but we did not feel, from past experience, that we dare ask for anything better than that the reading should not change by more than 0·5 millibar for a change of 20° F. The instrument certainly overcomes two other difficulties which have been mentioned by other speakers: it is robust, and it can be used in any position.

My own interest in aneroids is in their use for meteorology, and we are not concerned with accuracies better than about 0·2 millibars. This is inevitable because, whenever there is any appreciable wind, eddies round the building affect the pressure inside the building to at least this extent. It would be meaningless in these circumstances to measure pressure with any greater accuracy. I have some experience of the accuracy of available aneroids. In my office are about twenty instruments which, together with two mercurial barometers, have been read every day for about a couple of years. The best of these aneroids (made by Kelvin and Hughes to our specification) has an accuracy such that 95 per cent. of the readings are within 0·2 millibars of the average of the two mercurial barometers. The two mercurial barometers rarely differ by more than 0·2 millibars. Less accurate ones, which cost about £30 to £40 each, including some made by Taylor-Short and Mason, have an accuracy of about 0·5 millibars. No significant regular drift of calibration was found on any instrument but every aneroid has shown sudden jumps. Those jumps seem to occur four or five times a year. They go in both directions. The greatest jump has been about

2 millibars. The cause of these jumps is not known but they constitute a serious difficulty in the way of using aneroids for absolute pressure measurements.

Mr. R. F. C. CUNNINGHAM: I am a little worried by what Mr. Hamilton said about not using these altimeters on the tops of mountains. I have used them extensively for providing height control in air photographic surveys and for that purpose they must often be used on the tops of mountains, whether in the double-base method or in closing an altimeter traverse on triangulated heights. In that way we have produced many hundreds of square miles of mapping which seems to have been quite adequate for its purpose. The difference in the upper base and the lower base readings seemed to vary by very small amounts, usually by less than $\frac{1}{2}$ mb., or 15 feet.

Mr. R. A. HAMILTON: I did not really say you were not to use the altimeter on mountain tops. I was trying to give some idea of what your error was likely to be in rugged country in windy conditions. If you can make the corrections, a mountain-top position is as good as anywhere else. The drawback is that you often get strong winds on mountain-tops and more distortion of stream-lines.

The CHAIRMAN: I was rather disconcerted by Mr. Hamilton's remarks on the subject of stream-lines. It seems one has really to pick one's stations fairly carefully and avoid places where the stream-lines are likely to be squeezed together. I suppose you avoid being on anything which is sharply curved?

Mr. R. A. HAMILTON: Generally speaking, yes; but surely other considerations will determine the position of the point you want to survey?

The CHAIRMAN: If it is a point of known height, and you need it as a base station, you cannot always avoid it, but otherwise you probably could.

Mr. R. A. HAMILTON: I appreciate you may sometimes be able to choose a suitable point, but surely you cannot always wait for the wind to be less than 16 feet per second? The surveyor has to work in windy conditions and therefore one must try to get some estimate of accuracy of measurement. That is all I was trying to get at. Might I echo the plea that we do seem to speak two languages, the surveyor's and meteorologist's: we are using different units. I hope if any surveyors are going to start bringing their records to the meteorologist to work out they will measure their pressure in meteorological units, and not in altitude scales on the aneroid for which there is no conversion scale. All heights except for measuring difference should be expressed in pressure units, preferably in millibars. Referring to your 10-miles square and your interpolations, if you are in rough country and if there is any appreciable wind or heating you will still in that area get a meteorological inaccuracy of the order of a few metres irrespective of whether you have good aneroids.

The CHAIRMAN: I sympathize very much with Mr. Hamilton on this question of measuring pressures, and with what he said about "preferably in millibars." There was a resolution, which was put up and passed at the last Commonwealth Survey Conference but one, recommending that makers should, in addition to graduating their aneroids in feet, or in whatever rule they like, add a scale of millibars. Whether they have taken any notice of this is another matter. I am glad to hear meteorologists backing up those of us who supported that resolution.

Mr. W. W. WILLIAMS (Department of Geography, Cambridge): I can see a use for the aneroid among survey techniques where, if reasonable precautions are taken, the meteorological vagaries are of secondary importance, but where the reliability and accuracy of the instrument are the limiting factors. In Ceylon we used to spend large sums of money making reconnaissance contour surveys of areas which, it was hoped, would be suitable for irrigation. Thus it was necessary to know the nature of the relief; but because the country was so thickly forested, levelling was impossible until the lines had been cleared. The rate of clearing in such country was painfully slow. Now if we had had aneroids accurate to 2 feet, they would have been invaluable. We could have waited for stable atmospheric conditions and could have observed along small closed circuits, so that any error due to air mass changes could have been minimized.

The limiting factor becomes the instrument. Recently I have used several aneroids, many of them permitting readings to an accuracy of 2 feet, and indeed repeated observations have frequently agreed with 3, 4 or 5 feet. But suddenly, for no reason that I have yet discovered, I have had readings which have been erratic by 15 or 20 feet. I suspect that this is due to stickiness somewhere in the magnifying devices, but it is of course very disconcerting, and such errors cannot be tolerated in any kind of irrigation surveys. I still think, however, that if these errors can be eradicated by the makers the aneroid would be a most useful instrument for carefully controlled surveys of small areas; the advantages of the instrument in heavily forested country are, of course, obvious.

Mr. F. SOLARI (Ministry of Supply): In this kind of instrument there can be a considerable difference between sensitivity and accuracy. It is possible to devise mechanisms which will so magnify the diaphragm movement that one can detect a very small change of pressure. But due to the properties of the diaphragm and linkage, the repeatability may be nothing like the sensitivity. I am inclined to agree that some of the very fine graduations used on some instruments are meaningless.

In travelling recently with a very small party in partly surveyed country, we had the problem of carrying heights forward as we went, but with a lower order of accuracy than any quoted by previous speakers. We did all we could to record aneroid readings and air temperatures, evening and morning, but nevertheless had large cumulative errors. Much of this may have been due to uncertainty in our measurements of air temperature in strong solar radiation. And on one occasion, I was fascinated to observe the pointer of my aneroid walk around the dial as the shadow of the tent moved off it, showing that one should not trust the compensation too far. I should like guidance as to whether one can deduce from wind velocity the rate of change of pressure per mile. In regard to the earlier discussion on taking aneroid readings from a helicopter, I consider it essential to land and to stop the rotor before attempting any readings.

There is one point which I do not think has been mentioned in the discussion on the merits of calibrating aneroids in pressure units instead of height units. If one has a capsule which has a linear pressure law and tries to convert this into a linear height law by means of any system of levers, one inevitably obtains an error curve which is roughly sinusoidal. This would account for some of the errors to which Colonel Biddle referred. One may take the argument further, and assert that if you do not put a computing mechanism into a pressure-sensitive instrument but make it read pressure directly, you are likely to obtain much more accurate results. The computation may always be performed more accurately than by means of the linkage inside an instrument.

The CHAIRMAN: Brigadier Shewell and I tried in Egypt some years ago to deduce the pressure gradient from the wind, but it did not seem to work. I think the trouble is that one is too near the ground and so one gets a great deal of friction. The wind must be a true geostrophic wind without any frictional effect. I think Mr. Hamilton can say whether that is so or not?

Mr. R. A. HAMILTON: I am not sure what latitude you were in.

The CHAIRMAN: We were in lat. 30° N.

Mr. HAMILTON: You are beginning to get down to the regions where the geostrophic equation does not apply. Yes, the friction will bring the velocity down.

The CHAIRMAN: If you look at the ordinary weather charts every day even in lat. 55° in theory the wind arrows should be tangential to the isobars whereas usually they point inwards at an angle of some 30 degrees. It is the frictional effect that is giving you the error.

Brigadier H. A. L. SHEWELL: May I come back a moment to the question of accuracy of the instrument? It seems to me that there is a fundamental difference of opinion between the practical meteorologist and the instrument maker. We heard one meteorologist say just now that, when there is a light wind blowing, it is waste of

time trying to determine the pressure to better than 0·2 mb. That is in a building. The instrument makers say their instruments will give results to 0·4 foot, which is about 0·015 mb.; that is, roughly one-thirteenth of the error that the meteorologists say you get due to pressure variation in a building with a light wind blowing. I would like to hear the practical meteorologist's candid opinion as to what error he would expect, due to wind eddies and so forth, if he were standing in an ordinary bit of English countryside, instead of in this building, with a wind blowing at say 10–15 miles per hour. In a building it would apparently be jumping 0·2 mb., say 5 feet. Would this be reduced to 0·4 foot outside? If so, why doesn't he come outside? But if it does jump, by even half of 5 feet, is the accuracy of the instrument worth while?

Dr. R. FRITH: In a 10-knot wind errors up to about ¼ millibar (8 feet) are likely, caused by wind eddies round obstructions. I see no way out of this difficulty except the use of a static head—one insensitive to wind direction.

The CHAIRMAN: I understand it is an instrumental error that you are talking about?

Dr. R. FRITH: The pressure the aneroid is measuring is not the static pressure.

The CHAIRMAN: And you would need a long extension for a static head especially on top of a hill?

Dr. R. FRITH: Yes; but even on a plain the presence of the observer, or even the presence of the instrument, might introduce errors as great as 1 foot unless the wind were less than 2 knots.

The CHAIRMAN: In other words you would always require an extension of several feet to remove the error.

Mr. J. P. SHORT (North-Western Polytechnic) requested the Chairman to enquire whether anyone present had successfully used the modern type aneroid vernier barometer reading legibly to 1 foot for engineering survey work. The Chairman replied that there appeared to be nobody present who had so used a sensitive barometer.

Brigadier M. HOTINE: A point that has not been made is that we surveyors normally use these instruments in parts of the world which have not been surveyed at all; perhaps it is a dispensation of Providence that in those parts of the world there are usually fairly stable meteorological conditions—either good enough, or too bad to work at all, and perhaps that is why we do in fact get surprisingly good results. Much of this discussion may lead to the conclusion that aneroids are quite useless or, in the alternative, that they are good to 0·4 of a foot, whereas the truth lies somewhere between the two. I hope that instrument makers will not be discouraged when they are asked for 0·4 foot. We may sometimes make an error of 10 feet even in stable meteorological conditions, but that does not mean we can afford to give the instrument maker another 10 feet. We do not want to give the instrument maker any more than we can help. We gain in confidence by reading the same foot every time, even if it is the wrong foot, whereas the reading of the older type of aneroid depended too largely on the violence used to tap it.

Mr. E. F. GREENING (Negretti and Zambra Ltd.): It has been very interesting to listen to the surveyor's point of view and to gain some appreciation of the efforts he has made to obtain accurate readings from his precision aneroids. As an instrument designer, the stress that seems to be laid on the sensitivity, in one case 6 inches altitude, made me wonder if it is realized that high sensitivity does not necessarily mean that the instrument is more accurate by virtue of this quality alone. It may be of interest to note that in order to indicate an altitude change of 1 foot, the precision aneroid must sense a movement of the diaphragm element of less than 4×10^{-6} inches. Machines made to measure such small dimensions are housed in temperature-controlled rooms. The precision aneroids that have been referred to this evening are compensated against errors caused when the whole instrument is at any one temperature within a limited span, but no compensation is provided for temperature gradients caused while the instrument is cooling or warming to the ambient temperature experienced in the field.

The CHAIRMAN: The gravimeter is a portable precision instrument sensitive to changes in gravity a good deal smaller than one part in a million.

Mr. E. F. GREENING: But this is not a comparable instrument. It is not a field instrument.

The CHAIRMAN: Yes, the gravimeter is a portable instrument expressly designed for use in the field.

Mr. R. A. HAMILTON: It has thermostatic control.

The CHAIRMAN: It has the advantage that it can be sealed from outside air for gravity measurement, and therefore you can control its temperature. I was only suggesting that makers should not despair; it is possible in a portable instrument.

Mr. PETER WILKINSON (Department of Geology, Sheffield): I am a geologist and my experience of surveying and meteorology is of a severely practical nature. I would like to refer to the work of an expedition organised by the Geology Department of the University of Sheffield, which went out to Kilimanjaro, Tanganyika, in 1953. The main objects were geological and we were faced with the problem of position-fixing, for geological-mapping purposes, on a high mountain with very steep slopes. On the assumption that the existing map at 1:50,000 was of good quality we borrowed, from the Society, some small altimeters, made by the Swiss firm of Thommens, in the hope that a combination of compass cross-bearings and aneroid heights would give fairly good fixes. On the mountain we found that the map was, in fact, mostly of indifferent quality and sometimes very inaccurate. The altimeters, on the other hand, seemed very reliable and I collected a good deal of data in the hope of improving the mapping. My main point is that it does seem that there are some climatic regions—and this was one—where the air-masses are sufficiently stable for the aneroid to be used reliably without barographic, or even regular base-station control. The only control used (by force of circumstances) was that of checking the height of camp on leaving in the morning and on return in the evening, and of any other relatively well-fixed point visited during the day. Nevertheless internally consistent results were obtained. Certain aneroid traverses were completed several times, in fragments on different days, and it proved possible to complete three linked altimetric triangles. These covered a horizontal distance of 12 miles and a height difference of over 7000 feet (11,920 to 19,340 feet), the side of each triangle being determined as the mean of between two and nine separate traverses (average number 4.4). The altimeter could be read by estimation of 5 feet. The triangular closing errors were zero, 10 feet and 10 feet! Although high accuracy cannot be placed on the heights obtained, these small closing errors can hardly be coincidental and indicate a fair degree of reliability for the data.

My second point concerns the topographic control of aneroid height determinations. The height interval between Hans Meyer-Spitze (summit of Mawenzi, second highest peak of Kilimanjaro, and about 17,000 feet high) and Mawenzi Hut was determined trigonometrically as 2000 feet. Several aneroid trips (which agreed within 10 feet for the up and down journeys) gave a good mean figure which was 130 feet higher than the trigonometric figure. I have assumed that this discrepancy was due to a convectional up-draught on the side of the mountain opposite to the ascent route. This immense east face overlooks, almost perpendicularly, a great gorge, some 5000–6000 feet below and could well be the cause of a pressure-drop of the size involved.

Mr. W. THOMSON (Ministry of Supply): We have always found the high-precision types of aneroid particularly susceptible to transportation shocks. The instruments mentioned by Dr. Frith, which had been lying on his table for two years, had probably suffered little jolting and were therefore uninfluenced by this effect. When re-examining aneroids returned after about a year of field use we generally find considerable zero error present, which may be due partly to capsule ageing and partly to these shock effects. To maintain accuracy, I would advocate frequent resetting during the period of field operations; but this must be carefully done in comparison with a

reliable standard, preferably a mercurial one, and at intervals of about three months if at all possible. I am sure it is most inadvisable to make any zero adjustment except against some form of standard.

The CHAIRMAN: That bears out what Brigadier Hotine said. We do not want to discourage the instrument-makers, because if the aneroids read accurately and reliably they are more likely to read the same if you have a couple of them, and so your confidence remains supported by your instrument.

Mr. J. W. WRIGHT (Hunting Aerosurveys): In my opinion, the aneroid is not really a surveyor's instrument, because the surveyor should always know where he is, and if he knows where he is it is not all that much more difficult to carry his height with him. I am thinking of what Mr. Wilkinson said as to how they fixed their bases fairly well on Kilimanjaro by altimeter. When doing that surveyors might carry their heights along at the same time. Where people find differences from the map they are apt to think in terms of height only: but the apparent errors in height are often due to errors of position.

The CHAIRMAN: In air survey work it is relatively easy to produce plan positions from the photographs but rather more difficult to produce height. You can do without a minor triangulation between one primary station and another, or between one astrofix and another, and yet you may want intermediate heights. I think that is really the advantage of an independent method of getting heights.

Mr. J. W. WRIGHT: I think I could make this one more point as to why the aneroid is not a surveyor's instrument, and that is because of the unreliability of it, and the sudden changes. The surveyor likes to know at the end of the day or the end of the week's work how good his work has been. With an aneroid he often does not know that.

The CHAIRMAN: If you compare aneroid heighting with gravity surveys, apart from the meteorological conditions, you will find they have both gone through the same kind of history. I can remember assisting Sir Edward Bullard in a gravity survey in, I think, 1934, when we used a pendulum apparatus. The sudden application of brakes in the vehicle carrying them was always regarded as dangerous procedure because of the instability of the instruments. Since those days methods have been improved and, where it is applicable, the gravimeter is giving greater accuracy with greater reliability. If you are thinking of instrumental errors the same improvement has taken place in the same period with the aneroid and I do not see why in another ten years you should not get the reliability for which you are looking.

Brigadier H. A. L. SHEWELL: Has Mr. Wright ever had an opportunity of using the Wallace and Tiernan instrument?

Mr. J. W. WRIGHT: I have not myself used the Wallace and Tiernan Company's aneroid. There was an experiment carried out by the Sudan Survey Department and they were able to get something of the order of 3 metres.

The CHAIRMAN: We have had a very full discussion, and it only remains for me to thank our three speakers for having given us three most interesting papers.

A NOTE ON MASIRA ISLAND

GERALD DE GAURY

A Swiss geologist has called Masira Island "paradis d'un pétrographe." It is part of the territories of the Sultan of Muscat and Oman, lying some 150 miles south of Ra's al Ḥadd, the cape at the extreme eastern corner of the Arabian peninsula. It is 40 miles long and 10 miles broad, being divided from the mainland by a channel 12 miles wide. At the northern end of the island there is a haven from the monsoon, and to the south a 7-fathom deep passage runs in from the Indian Ocean and continues close to the inner shore of the island for about half its length.

Geologically the island is almost entirely of igneous rocks, assigned by the late Dr. Lees to the Semail series. Basalt, serpentine, diorite and gabbro are all seen on the island. Overlying this series is the sedimentary Eocene, confined, with a few small exceptions lower down, to three flat-topped summits. Their shape and light colour make a striking contrast to all the other and numerous dark peaks of the range running along the length of the island. Seen from a flank, Masira could be described as resembling a half-submerged dragon, the notched hills along its length being the comb on the creature's back, the smooth plain at the northern end representing its neck and the reef off the northern point the dome of a submerged head. The central axis of the range is, however, broken by a gap at the centre of the island allowing easy access from coast to coast. The maximum height of the range, at the shoulders of the dragon as it were, is attained at Jabal Madrūb, a conical hill 620 feet high.

The climate is exceptionally agreeable. The hottest month is May, when the average maximum is 96° F, humidity 77 per cent. and minimum temperature 77°. After May the effect of the monsoon begins to be felt, and the temperature falls. The coldest month is January, when the average maximum is 78° and the minimum 66°, with humidity at 64 per cent. In August, the average maximum temperature is 86°, the minimum 72° and humidity 74 per cent. with winds S. to SW. at between 10 to 15 knots. The prevailing wind is S. to SW. throughout the year except between November to March when it is usually from SE. or NE. at 10 to 15 knots during the day and 5 to 15 knots at night. In April the wind begins to veer once more to S. and SW. usually at 5 to 10 knots and gradually strengthens until it reaches 20 to 30 knots in July. The visibility is hardly ever known to be low enough to make a landing from the air dangerous, though sandstorms do occur sometimes between July and September. When the wind is strong from the south-west, thick spume covers the southernmost extremity of the island.

Vegetation is scarce, though drinkable water is found frequently at between 6 and 12 feet near the shore. A few springs of water in the centre of the island support straggling date-palms in gullies draining eastwards. The direction of the two largest watercourses in eastern Arabia, which come from the Eastern Hajar range (9000 feet) is towards Masira Island, and though both of them disappear before reaching the coast of the mainland it is possible they continue subterraneously. More wells than those now worked on Masira were once in use and more palms cultivated than at present. The inhabitants today live in villages and hamlets on the coast, in small huts made of palm-fronds, their livelihood being gained from the sea, with dried fish as the chief export.

The place names shown on the map accompanying this note have been checked locally and are now believed to be as accurate as they can be. The language is Arabic and a short list of unusual topographical terms is given on page 502.

A count of the huts on the island, allowing five persons to each hut, gives a total of just under two thousand inhabitants. At certain times of the year some of the men are away at sea, going with small sailing vessels as far as Zanzibar and Mombasa, or

to Sūr in the Persian Gulf. The Sheikh, Khamis bin Majid, himself a fisherman owning two small boats, and by descent a member of the Junuba tribe, lives in a hamlet at Ra's al Yā' on the ocean side of the island.

In the spring, at night, very large numbers of turtles come ashore to lay their eggs and sperm whales are at times numerous off the Indian Ocean side of the island. The crayfish are unsurpassable eating. Sea-birds are often to be seen in large numbers and gazelle abound in the interior. There are only a few sheep, goats and donkeys and no wheeled transport other than that of the R.A.F. The airport, a civil one, is administered by a detachment of the Royal Air Force, whose camp is beside it at the northern end of the island, where there remain the ruins of a wartime U.S.A.F. route station. There is an abandoned Imperial Airways Flying-Boat station and a former R.A.F. camp (1936) half way along the inner side of the Island.

A. Sprenger, in his 'Die alte Geographie Arabiens,' pages 134 and 135, gives the arguments and authorities for the early names of Masira being Orgyris and Organa and quotes Nearchus and Orthagoras as saying that the tomb of King Erythras, "a large one on a hilltop with wild palms nearby," was upon the Island of Orgyris. This story and the mysterious inaccessability of the island lent legendary fame to it.

The author of the Periplus of the Erythraean Sea, writing in the first century A.D., who knew Masira as Sarapis, says "sailing along this coast well out at sea for two thousand stadia from the Zenobian Islands [now called the Kuria Muria Islands], there meets you an Island called Sarapis, about one hundred and twenty stadia from the mainland. It is about two hundred stadia wide and six hundred long, inhabited by three settlements of Fish-Eaters, a villainous lot, who use the Arabian language and wear only girdles of palm-leaves. The Island produces considerable Tortoise-shell of fine quality and small sail-boats and cargo ships are sent there regularly from Cana." In the modern edition of the Periplus, annotated by W. H. Schoff and sponsored by the Philadelphia Museums, in note 33, p. 146, the "Arabian language" is explained as being in fact "Himyaritic or Hadramitic, represented by the modern Mahri." In the author's day the mainland had recently been conquered by the Parthians, then at war with Rome, though the trading connection of Masira was nevertheless still with the Habasha (Asiatic Aethiopians), and with Cana on the mainland further south. "Active Indo-Scythians," of the Indus Valley, are said by Pausanias (VI.26), in a somewhat confused account, to have been on Masira Island in his day.

Speaking of the name Masira, Schoff comments that "the syllable *Sara*pis or *Masira* is probably the same as the tribe name Ausar or Ausan, mentioned by the author earlier. (Ausan was a district of Kataban in S. Arabia.) This explanation must seem at least doubtful. The author of the Periplus assimilates the same syllable to that of the Alexandrian Osiris, of the bull-worship, or in the Latin, Sarapis. The worship on Masira about this time and earlier, as on Socotra Island, appears in reality to have been that of the Sun-god. Mr. Randles, of the British Institute in Lisbon, has pointed out that the following ways of naming Masira have been used on old sailing charts and maps; Damagra, Demacira, Dimacira, Macejra, Maceria, Machira, Mezeret, Misira, Organon, Organa, Serapides insula and Serapeon. *Sira* is nowadays used to mean an island off a headland, at least in South Arabia, and Sarapis may be merely the Greek version of an Himyaritic topographical name, which supplanted that of Orgyris. This origin of the name would seem to have confirmation in the argument by Schoff, elsewhere in his notes on the Periplus, that Sarapis could be from Serandip "a name given by the Saracens to Ceylon, but which apart from its last syllable the Sanscrit Dvipa, or island, seems to be related to the island Sera, or Masira."

The known history of Masira Island is rather less than scanty. On a Venetian planisphere of Fra Mauro made for the King of Portugal (A.D. 1460, and so dated before the capture of Hormuz by the Portuguese), which is reproduced in A. Kammerer's 'La Mer Rouge, l'Abyssinie et l'Arabie,' published by the Royal Geo-

Pleistocene & Recent
Eocene limestone
Igneous rocks
Miles
0 5
A
B
Ra's Half
Jetty
Kināʾat Half
Monument
Ra's Qudāfah
Airport
RAF Camp
58°55'
20°40'
Jabal Half
Bāy Bin Qumayim
Dafīyāt
ʿAyqah
1. Qummat al Mukhaffār
2. Wādī al Ghadar
3. Juzayrah
J. Safrah
Shīnāṣ
J. Madrūb
620
Dawwāh
J. Hamrah
905
J. Shabbah
Ra's Shughf
ʿAyn Dawqah
W. Dhū Jarbūʿ
W. Lajfīn
Ra's al Wa
Ra's Zaʿfarānāt
58°45'
20°30'
Jazīrat Shughf
Umm Ruṣayṣ
Al Ḥuwr
Safāʾiq
Sūr Maṣīrah
Ra's Rādum
Jabal Khīrān
Ay Qāria
Jazīrat al Ḥar
Ḥuqul
ARABIAN
SEA
58°55'
20°20'
Ra's Ḥimārī
W. Khīrān
Kilbān
Ra's Kaydah
W. Ghūb
Urf
Lābān
Ra's Zarri
W. Ḥabarūt
Ra'hid
Fad
Sanfah
J. Suwayr
488
Ruhān
W. Kharūs
58°45'
20°10'
Ra's Abū Raṣāṣ
Ra's Maṭrah
MASIRA ISLAND
(MAṢĪRAH)
Miles
Tracks
Wells
Reefs
Dry washes
Heights in feet

graphical Society of Egypt in 1929, Masira is shown as a place having a castle and walls of middle size, a little smaller than those of Muscat, and about the same size as those representing Aden. The traces that remain of a castle may therefore not be Portuguese but earlier, and Arab. The nearest of the legends on the map written across the mainland south-west of Masira, reads "Arabia Latea, the noblest. Here is found cinnamon, incense and precious stones—," but it would seem to refer to Dhofar rather than to Masira, that district and a castle also being reproduced and named "Dofa" on Fra Mauro's work. Here and there on the island are found the remains of ancient opencast mining, of which the inhabitants are today quite ignorant, having even lost knowledge of their whereabouts. There are vestiges of a fort and walls near Sūr Maṣīra village, named in Lorimer's Gazetteer of the Persian Gulf as the capital of the island, which are said to be Portuguese and the two ancient guns outside the R.A.F. Officers Mess, which came from it, do seem to be of the Portuguese date. There are tales handed down of "Faras min Europa" (Persians or "foreigners" from Europe) at one time coming annually for two months, though "they always re-embarked at night," it is added, a detail which seems to smack of truth. Near the abandoned village of Fād, in the south of the island, there are weather-worn headstones of tombs, with what appear to be early Persian inscriptions. They are in a group near a steep and narrow declivity, in which is water, palms and caves, 50 feet lower than the surface of the surrounding desert. The fate of the survivors of the British ship, *Baron Inverdale*, in 1904, on Masira Island, is recounted by Sir Arnold Wilson in his book 'The Persian Gulf.' A monument on the northern coast of the island commemorates their death, on the spot where they met it, at the hands of men later executed there by order of the Sultan of Muscat.

Although Masira Island is today almost barren its climate is quite exceptionally good, and it is doubtless the air and temperature which contribute to make it pleasing beyond expectation. What the eighteenth century French author Sigrais said of "l'isle imaginaire" applies to Masira, "la douceur de l'air y est grande, et le plaisir qu'il y'a à le respirer est inconcevable."

SOME UNUSUAL TOPOGRAPHICAL TERMS

bāy	Reef, which gives boats shelter. It may be above or under water.
khayṣah	Beaching place for fishing canoes.
ṣīrah	Peninsula, or island off a headland.
kināsah	Very small hill, or hillock.
kinsīr	Hummocks in lava or of lava.
ḥishḥaysh	Coral (elsewhere called ḥarmal).

Transliteration from the Arabic by the BGN/PCGN system

DIFFERENTIAL WEATHERING AND EROSION ON OLDLANDS

R. S. WATERS

DIFFERENTIAL WEATHERING and erosion are the epigene processes whereby rock structure is given topographic expression. They are the processes by means of which adaptation of surface to structure is effected. Their role in the evolution of landscapes on a series of alternating weak and resistant beds has long been appreciated. The differing topographic expressions of sub-parallel rock outcrops on a maturely dissected coastal plain have long been attributed to sub-surface weathering and surficial erosion of materials more or less amenable to break-down and removal. Thus the structurally adapted cuesta landscapes of the English Plain are recognized as witnesses of the efficacy of these processes on simply disposed but varied Mezozoic and Tertiary sediments. But an appraisal of the significance of these processes in regions of more complex structure has yet to be made, and it is as a contribution to that study that this paper is offered. It is based on the results of observations carried out on the Dartmoor tract of the oldland of south-west England.

In so far as such oldlands are concerned the effects of differential weathering and erosion are most commonly conceived on two very different scales. Differential erosion is invoked to account for major differences of form and relief as between one assemblage of associated land forms (*i.e.* one morphological region) and the next. For example, in south-west England the Dartmoor upland as a whole is generally recognized as an impressive product of differential erosion. Indeed, differential denudation is the process or group of processes by whose means are created the tracts in Professor Linton's hierarchy of morphological regions (Linton, 1951). At the other extreme in geomorphological study, differential weathering is credited with the execution of the finest details of surface form, like the irregularities of the jagged outline of a ridge crest or the diminutive rock basins which pit the surface of some granite slabs on Dartmoor (*i.e.* with the decorative etching of the individual land form). But with a few noteworthy exceptions like that of Professor Linton's treatment of the origin of tors (Linton, 1955) there have been no records or discussions of the effects of differential denudation at an intermediate level in the landscape. Its roles in land form creation as in landscape modification have largely escaped notice; consequently its significance in the morphological evolution of oldlands has frequently been overlooked.

Basic elements in the morphology of Dartmoor.—The chief features of the Dartmoor landscape are too well known to require detailed enumeration. Best known are the tors which, as Linton has shown, are examples *par excellence* of differential etching. But the summit tor is a residual element of the landscape whose presence betokens a differential lowering of the surface of sound granite: its complement on the Moor is the "basin"—a relatively broad, shallow, saucer-like depression.

These two land forms—basin and tor—are ubiquitous over the greater part of the upland. It is of no little significance that they are absent from the central parts of the northern and southern plateaus whereon are preserved substantial relics of the southward sloping surface of the block from which the existing landscape has been fashioned.

Each moorland valley comprises a series of basins and gorges. In fact, the present interpretation of the Dartmoor surface as the result of an agglomeration of basins was conceived as the most satisfactory solution to problems posed by breaks of slope in the transverse and longitudinal valley profiles. The valley of the moorland Plym above Shaugh Bridge (20/533637) will serve as a typical example (Fig. 1). The river

rises at 1500 feet O.D. near the centre of the plateau of southern Dartmoor and follows a zig-zag course across the granite and a roof pendant of killas in a general south-westerly direction. It takes its rise in a peaty, saucer-like depression shallowly cut below the undulating plateau surface and descends in a series of steeply and gently falling reaches through some 1200 feet in 8 miles. Narrow, V-shaped valley sections are associated with the steeper reaches below sharp breaks of slope in the long profile; broader valley-floor segments are characteristic of the flatter reaches.

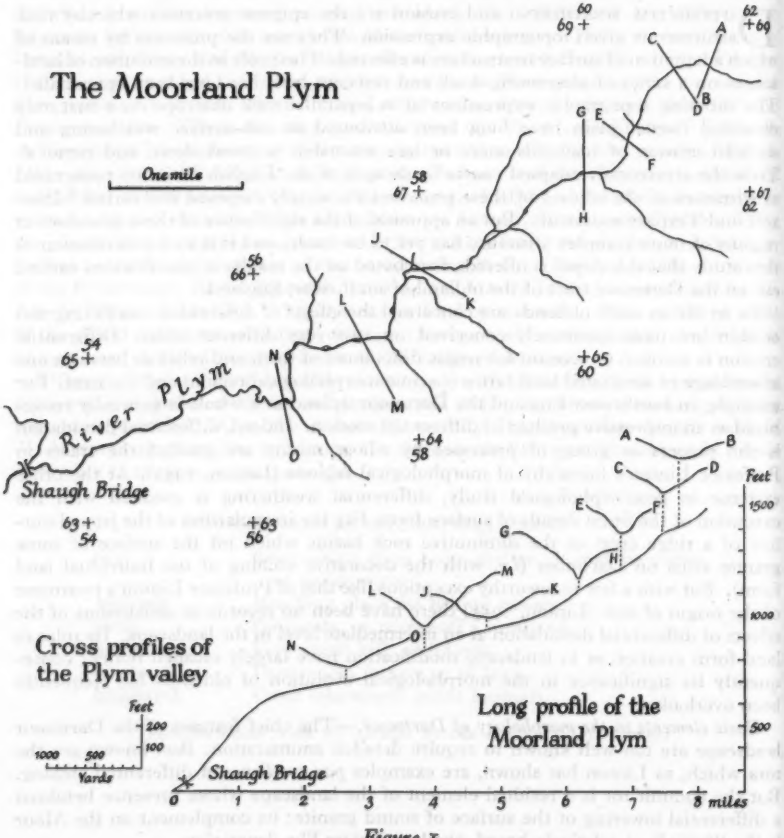


Figure 1

In short, the valley comprises a series of confluent basins whose formation cannot be attributed solely to fluvial action. The river has seven mile-long tributaries, five of which, like the headstream, join the main valley from the south-east on sub-parallel courses. The two right-bank affluents also flow parallel with portions of the main stream. All save two of these larger tributaries join the main stream in basins, and diminutive subsequent outgrowths are developing in those basins not already marked by a larger confluence. Clearly the whole river system is becoming ever more closely adjusted to structure: but the precise nature of the structural control is as yet incompletely understood.

Similar valley forms and structurally adapted stream segments are to be found all over the upland, but it is reserved for the northern part of the Moor to display them most convincingly (Fig. 2). On northern Dartmoor about the headwaters of the rivers Okement, Taw and Teign the relief pattern forms a network whose lineaments are orientated in one of the two directions NNE.–SSW. and NNW.–SSE. The entire landscape is made up of "positive" (*i.e.* upstanding) and "negative"

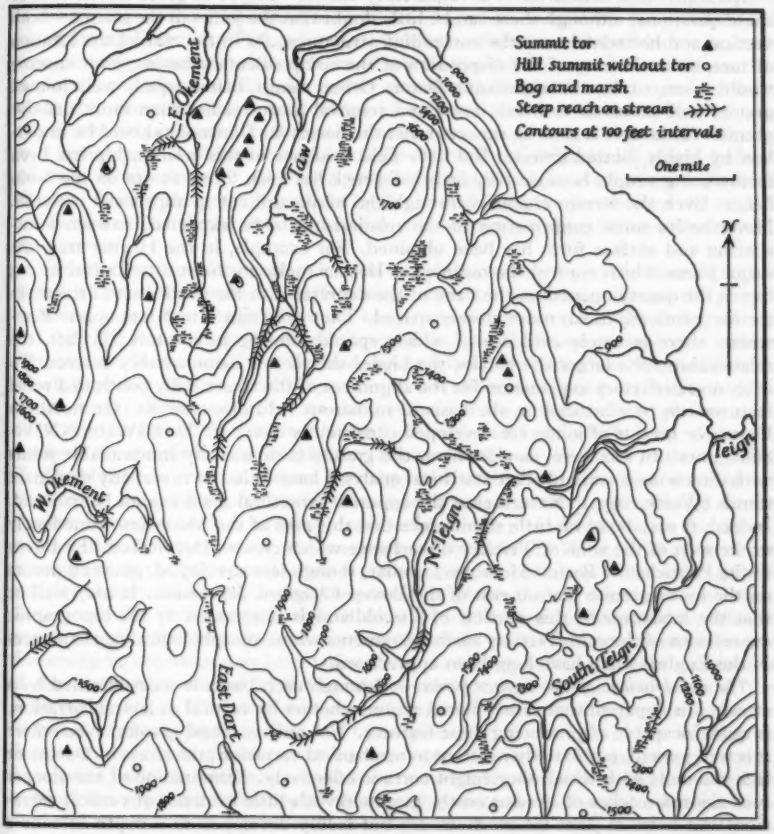


Figure 2

(*i.e.* depressed) lineaments. Low cols and boggy depressions on the interfluves serve to complete the discontinuous pattern exhibited by the drainage lines. Likewise, the main outlines of the analogous pattern provided by the major stream divides are reinforced by identical alignments of smaller upstanding features like valley-side spurs, knolls and ridges. The intersection of two positive lineaments is always marked by a bold and often tor-crowned relief feature, while that of two negative lineaments is betrayed by an equally impressive basin-like depression. Where a positive lineament crosses a river valley, there the valley narrows and a break of slope occurs on the valley floor; on the other hand a major interfluve is invariably lowered where it is

crossed by a negative lineament. Few clearer examples of structural control could be cited. Many of these head-streams are truly subsequent; others, initially discordant, are becoming progressively adjusted to structure as they exploit the intersecting zones of weakness in the granite. But, we may ask, what exactly are these zones of weakness and how precisely are they exploited and given such distinctive topographic expression?

The controlling structures.—No satisfactory answer can yet be given to the first of these questions; although there can be little doubt that the joints in the granite—both vertical and horizontal—are the controlling structures. As in the case of the location of tors, so in the case of the disposition of the complementary basins, joint spacing would seem to be the significant factor. Other things being equal, well jointed granite will succumb to break down and removal more readily than more massive granite. Therefore it is to be expected that the basins on Dartmoor should be underlain by highly jointed granite. But little field evidence of this relationship has been forthcoming simply because very little solid rock has been found *in situ* on the basin floors. Even the stream channels through the basins are cut in superficial material. Nevertheless some confirmation of the relationship to be expected between joint-spacing and surface form has been obtained. For example, in the Haytor area, the major joints which control the outlines of Haytor rocks are from 6 to 12 feet apart; but in the quarry opened on the flank of the depression to the north-east of the main tor the joints are much more closely spaced. They are from 1 to 6 feet apart. Elsewhere, there is ample evidence of widely spaced jointing in the tors; in fact, the relationship—the larger the blocks, the bigger the tor—is demonstrably correct. To date, no satisfactory explanation for the alignment of the structurally controlled relief features can be advanced on the basis of numerous field observations. On northern Dartmoor no sets of joints are developed consistently along NNE.–SSW. or NNW.–SSE. lines. In fact here, as elsewhere, the granite is divided by innumerable joints with directions so variable that statistical analyses have failed to reveal any dominant trends (Worth, 1953). Nevertheless the apparent structural grain cannot be gainsaid. Indeed, it may be of no little significance that this area of the Moor lies immediately to the west of the zone of Tertiary disturbance which crosses Devon from the Bovey to the Petrockstow Basin. Moreover, similar, though less developed, graining occurs on the lower granite plateau east of the Bovey–Chagford depression. It may well be that the landscape of this portion of the oldland is dominated by the topographic expressions of the mid-Tertiary earth movements whose morphological consequences in the English Plain have long been appreciated.

The development of the surface forms.—Although each basin is today drained by a stream it is apparent that direct fluvial action, whether by vertical or lateral corrasion, is quite incapable of producing these features. Not only is sound granite, even where it is well jointed, particularly resistant to mechanical corrasion; the rivers of Dartmoor lack the tools with which they might corrade effectively. Examination of the steeper rock-floored reaches of streams on the granite reveals little evidence of vertical corrasion. Pot-holes at joint intersections are but feebly developed to a depth of 1 or 2 inches. By contrast on equally steep channel segments on the metamorphic aureole pot-holing is ten times as effective. This is because the altered sediments yield debris of all sizes, including sharp-edged pebbles which are ideal tools for abrasion, whereas very few such pebbles are present in the streams on the granite. These latter are either encumbered with large blocks of sound granite or littered with coarse granite sand, both of which are equally ineffective as abrasive loads. In fact, observation suggests that the little fluvial corrasion that is accomplished on the granite is effected by means of pebbles yielded by mineral veins, aplite dikes, schorl reefs and the like which traverse the igneous mass. In spite of this apparently small amount of down-cutting the streams may be regarded merely as conduits whose function is confined to the evacuation of material supplied to them by creep, wash and other processes active in the modification of their valley-side slopes. That river erosion must be discounted as the major process in the fashioning of the basins is also suggested by

the fact that the size of a basin is quite unrelated to the size of the stream now occupying it. Equally impressive basins exist about the headwaters of minor streams as along the courses of larger rivers. If it is impossible to attribute basin formation to the work of existing streams it is also well-nigh impossible to envisage changed climatic conditions under which fluvial corrasion of the granite could have been made more effective.

A minority of earlier workers, unable to accept the valley forms of the higher parts of the upland as the unqualified work of running water, suggested the possibility of ice action on Dartmoor (Pickard, 1943). The idea of glaciers on the Moor was, however, strongly opposed by the officers of the Geological Survey and no evidence has come to light which would lead one to question their well-founded opinion (Reid, 1912). No unmistakeably glacial forms have been identified on the upland and, as was first clearly indicated in the geological memoir, no spreads of superficial material have been observed which cannot be broadly classified as solifluction deposits. Indeed, evidence of mass movement under periglacial conditions is everywhere most convincing. Clearly the possibility of the basins having arisen as the result of the modification under periglacial conditions of a pre-existing topography deserves careful examination.

Madame Beaujeu-Garnier in a detailed morphological survey of the Massif Central of France has demonstrated the effectiveness of such a metamorphosis on the granite terrain of Limousin (Beaujeu-Garnier, 1953), and still more recently Professor Cotton and Mr. Te Punga have described the modification of a more or less level upland surface near Wellington, New Zealand, by periglacial processes involving solifluction which probably alternated with episodes of vertical stream incision (Cotton and Te Punga, 1955). Cotton describes as characteristic of the margins of the plateau remnants, certain broad and shallow "dells" of gentle declivity which hang above the heads of the steeply falling, deeply cut ravines that dissect the flanks of the uplands. He likens them to nivation cirques but suggests that they may have been scooped out by streams of solifluction debris. These dells bear a marked resemblance to the smaller Dartmoor basins, but they occur only as valley-head hollows on the deeply weathered and maturely dissected greywacke of the Belmont Plateau. They seem not to occur, as do the basins on Dartmoor, lower down the valleys as well. Although the periglacial formation of dells was preceded by a phase of deep chemical weathering, Cotton and Te Punga suggest that in addition to the mere solifluctional transfer of weathered material from the areas now occupied by dells a certain amount of actual deepening by corrasion may have taken place. According to this hypothesis, corrasion of the bedrock is effected by the stream of solifluction debris along the axis of the dell (Büdel, 1944). Te Punga has, in fact, reported "that solifluxional corrasion or 'shaving' of the bedrock surface has taken place very commonly in the Wellington district under the regolithic cover on the slopes of spurs" (Cotton, 1955, p. 1025). No shaved bedrock surfaces have yet been noted under the head on Dartmoor and in view of the apparent resistance of the sound granite to mechanical corrasion it is doubtful whether such a process of solifluctional corrasion could have more than a very limited effect. It is difficult to conceive of the development of basins by mechanical corrasion of sound granite whether by streams of waste-laden water or of solifluction debris. In any event, so far as the Dartmoor basins are concerned it seems unnecessary to invoke the operation of such processes of corrasion, although evidence of transfer of material by solifluction is everywhere to hand. Coulées and valley floor rubble drift terraces are as common on the Moor as they are in Limousin: in fact, most of the features accepted by Madame Beaujeu-Garnier as diagnostic of landscape modification under periglacial conditions are present on the higher parts of Dartmoor. But the distinctive land forms, the basin and tor, would appear so faithfully to reflect some structural grain in the igneous mass that no account of their development which does not recognize the dominant role of differential erosion is wholly acceptable.

Whether or not the final fashioning of the moorland surface was accomplished under

periglacial conditions the essential pre-requisite for its differential etching would appear to have been conditions under which the preparation *in situ* of a potentially transportable regolith could take place to different depths in different localities. The numerous exposures of decomposed granite, or growan, that are found away from the tors suggest that chemical weathering was the dominant process of rock preparation. Even under existing conditions it is probable that the granite, although mechanically resistant, is chemically weak. Above ground it is durable but under the surface within the zone of circulating, weakly acid, ground water it decomposes slowly by virtue of its unstable felspar. But the rate of chemical weathering would be some ten times as great under a hot-humid climate as under existing climatic conditions on Dartmoor. And Linton has shown that the first stage in tor formation, namely the sub-surface deep rotting of the surrounding well-jointed granite, is most likely to have occurred under hot, humid conditions. "Profound rock rotting to depths equivalent to the heights of our larger tors would appear to require not only a great deal of time but probably also a warmer climate than we now enjoy anywhere in these islands" (Linton, 1955, p. 478). As in the case of tor development the structural control of the differential depths of chemical weathering would seem to have been the density of jointing in the granite. The downward limit of decomposition in any potential basin would be set by the water table which was ultimately controlled by the water level in the stream. Continued vertical corrasion in the stream channel, however slight, would be accompanied not only by progressively deeper weathering, but also, and more significantly, by an extension outwards from the stream of the area of decomposed rocks. Under such conditions of warmth and humidity it is not inconceivable that the basin would develop as a topographic feature *pari passu* with the preparation of the transportable material. Today the growan carries a large amount of ground water; it is, in fact, that natural storage reservoir on the granite. Unlike its cover of peat, however, it drains readily and where the drainage is concentrated spring sapping occurs on valley sides. In the past, this and the related process of gullying must have been even more effective than they are today in causing the retreat of the valley sides of decomposed granite. Thus we may envisage the development of broad valley sections or basins in those localities where the granite was divided by relatively closely spaced joints. It would appear therefore that solifluctional transfer of regolith, although doubtless important, is not essential to their development on Dartmoor. In fact, observation of the disposition of the coulées of sub-angular blocks of all sizes and the drift terrace features suggests that many basins certainly pre-date a solifluction phase. Some are still littered with the larger blocks which formed part of the solifluction deposit of presumably the last periglacial phase. Many are floored with sub-angular rubble drifts which simulate climatic terraces.

If the dominant land forms of Dartmoor came into being during the Pleistocene there is good reason to regard them as the results of processes which were operative during the warm moist interglacial phases rather than during the colder phases marked by glaciation farther north. But the conditions that favoured the development of differential etching during the warmer phases of the Pleistocene were general during the earlier periods of the Tertiary. The climate was certainly warmer than at present while the Bovey Beds were being deposited during the Upper Oligocene and Lower Miocene (Reid, in Ussher, 1913) and similar conditions prevailed well on into Pliocene times. Therefore it is not unreasonable to suggest that much of the deep rotting of the more densely jointed granite, now represented by the thick cover of growan in the larger basins, occurred before the Pleistocene. There is, indeed, very little weathering of the relatively narrow rock-cut terraces which flank the Dart about Dartmeet, terraces which the late Mr. J. F. N. Green referred to base levels of the order of 800 and 900 feet above present sea level (Green, 1949). It is generally agreed that these little altered valley floor remnants date from the Lower Pliocene at the latest, and their relatively fresh appearance suggests that their cutting post-dates the main period of deep weathering.

It is therefore suggested that the differential weathering and erosion, which by

exploiting the weaker zones of the granite has given rise to the basin and tor topography, be referred to sub-aerial landscape development during the Miocene. The upland surface, so well adapted to structure above 1000 feet may be the representative on the more resistant rocks of the oldland of the Mio-Pliocene peneplain of south-east England (Wooldridge and Linton, 1939); and its discontinuous superficial cover of growan may be the analogue of the residual deposits which mantle the sub-aerial surface on the newer rocks of the English Plain. If that be so, the feature on Dartmoor was in no sense a plane surface, but rather an incomplete "etchplain," of the kind described by E. J. Wayland in Uganda (Wayland, 1934), which arose as the result of the differential lowering of a pre-existing fairly level surface whose unconsumed remnants exist only about the water partings on the northern and southern plateaus.

Conclusions.—By means of differential etching in an area of lithologically homogeneous rock, which is mechanically resistant but chemically weak, considerable morphological variety may result from the topographic expression of variations in joint spacing.

In areas of high available relief the resulting surface forms may simulate those of a polycyclic landscape; but they may be distinguished from the latter by their areal pattern. For example, the breaks of slope on the upper parts of the long profiles of the Dartmoor streams are tied as it were to the more resistant rock zones, probably because the controlling joints are vertical rather than horizontal. There is therefore no headward retreat of these breaks of slope as there would be of true knickpoints. In other words, local base-levels of erosion are of great significance because interstream degradation is rapid relative to stream bed grading.

Judged by the usual criteria, the landscape in such areas where the controlling structures are disposed vertically rather than horizontally is maintained in a state of sub-maturity until planation is accomplished by the coalescence of individual etchplains. On Dartmoor this stage was never reached, at least not since the formation of the summit plains of the northern and southern plateaus. The rounded outlines of much of the Moor which tend to mask its sub-maturity must be ascribed to the effects of periglaciation.

The recognition of such structurally adapted land forms as are exemplified on Dartmoor as relict sub-aerial forms and a delimitation of the area which they occupy may help to fix the limits of the late Tertiary marine trespass on the oldlands.

REFERENCES

Beaujeu-Garnier, J. (1953). "Modèle périglaciaire dans le Massif Central français," *Revue de Géomorphologie Dynamique*, 4, pp. 251–81.

Büdel, J. (1944). "Die morphologischen Wirkungen des Eiszeitklimas im gletscherfreien Gebiete," *Geol. Rdsch.* 34, pp. 482–519.

Cotton, C. A., and M. T. Te Punga (1955). "Solifluxion and Periglacially Modified Landforms at Wellington, New Zealand," *Trans. roy. Soc. N.Z.* 82, pp. 1001–31.

Green, J. F. N. (1949). "The History of the River Dart, Devon," *Proc. Geol. Ass., Lond.* 60, pp. 105–24.

Linton, D. L. (1951). "The Delimitation of Morphological Regions," 'London essays in geography,' pp. 199–217.

Linton, D. L. (1955). "The Problem of Tors," *Geogr. J.* 121, pp. 470–81.

Pickard, R. (1943). "Glaciation on Dartmoor," *Trans. Devon Assoc.* 75, pp. 25–52.

Reid, C., and others (1912). "The geology of Dartmoor," *Mem. Geol. Surv.*

Ussher, W. A. E. (1913). "The geology of the country around Newton Abbot," *Mem. Geol. Surv.*

Wayland, E. J. (1934). "Peneplains and some other erosional platforms," *Ann. Rep. and Bull.*, Geol. Surv. Dept., Uganda, pp. 77–9. L. C. King applied the term "etchplain" to the less extensive platforms recognized by Wayland (*Proc. Geol. Soc. S. Afr.* 50 (1947), p. xxvi).

Wooldridge, S. W., and D. L. Linton (1939). "Structure, Surface and Drainage in South-East England." *Inst. Brit. Geogr.*, publication No. 10.

Worth, R. H. (1953). 'Dartmoor,' pp. 61–3.

CARL LINNAEUS AS A TRAVELLER

EDWARD HINDLE, F.R.S.

The celebrations occasioned by the 250th anniversary of Carl Linnaeus, born at Stenbrohult, in Småland, on 23 May 1707, have been concerned mainly with his activities as the greatest naturalist of his age and the supreme classifier of animals and plants. It is sometimes forgotten that in his early days Linnaeus was no mean traveller and throughout his life encouraged his pupils to journey to far-off lands. To mention only a few of them, Hasselquist in Asia Minor, Forsskål in South Arabia and Löfling in Venezuela succumbed whilst on expeditions. Thunberg explored both South Africa and Japan, and Solander accompanied Joseph Banks on James Cook's first voyage to New Zealand and the east coast of Australia. Another pupil, Sparrman, accompanied Cook on his second voyage when they travelled further south than anyone before. Pehr Kalm's expedition to North America and Osbeck's voyage to China are other examples of travels which helped to establish the position of Sweden in exploration of the earth.

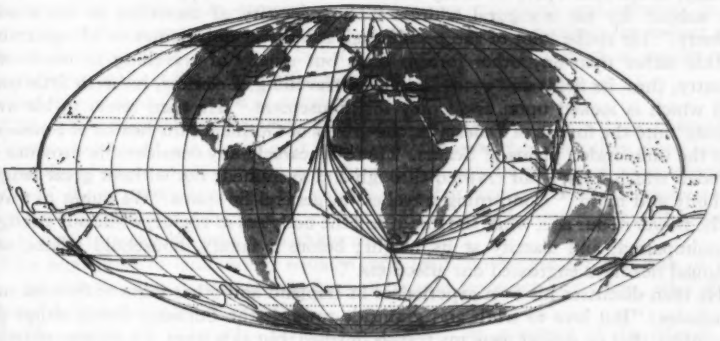
At the beginning of the eighteenth century Swedish Lapland was virtually unknown, at least so far as animals, plants or minerals were concerned. Linnaeus' teacher Olof Rudbeck had made a trip to that country in the previous century, but all his notes were lost in the great fire of 1702, which destroyed the whole of Uppsala including its cathedral and castle. Linnaeus often heard from Rudbeck of the rare plants and strange phenomena he had seen in Lapland and became inspired with a desire to go there. He was successful in obtaining a small grant from the Swedish Royal Society of Science, amounting to the modest sum of 400 dalars (about £10) for an estimated journey of 1440 miles. He started out on 12 May 1732, travelling alone on horseback and the description of his equipment is taken from his diary:

"My clothes consisted of a light coat of Westgothland linsey, without folds, lined with red shalloon, having small cuffs and collar of shag; leather breeches; a round wig; a green leather cap and a pair of half-boots. I carried a small leather bag, half an ell in length, but somewhat less in breadth, furnished on one side with hooks and eyes, so that it could be opened at pleasure. The bag contained, one shirt, two pairs of false sleeves and two half shirts; an inkstand, pencase, microscope and spying glass, a gauze cap to protect one occasionally from the gnats, a comb, my journal, and a parcel of paper stitched together for drying plants, both in folio, and my manuscripts on Ornithology, *Flora Uplandica* and *Characteres Generici*. I wore a hanger at my side, and carried a small fowling piece, as well as an octagonal stick, graduated for the purpose of measuring. My pocket-book contained a passport from the governor of Uppsala and a recommendation from the Academy."

He travelled northward along the coast until Umea was reached and then turned inland with the object of getting to Lycksele in southern Lapland. The spring thaw prevented his reaching the hills in the west, but he eventually gained the town of Lulea and went on up to the Lule River and made his way to Kvikkjokk, the last settled area in Sweden. From here, guided by a Lapp, he entered the mountains and glaciers forming the boundary between Norway and Sweden, and visited the Western Atlantic at Rörstad not far from the Lofoten Islands. He returned to Torneå on the coast road and continued round the Gulf of Bothnia through Finland to Åbo. From here he sailed home by the Åland islands reaching Uppsala on October 10.

This journey of exploration in one of Europe's least known areas was the basis of many learned publications which established his reputation as an authority on the fauna and flora of Lapland. He compiled a *Flora Lapponica* published in Holland in 1737, which also contained many of his observations on the Lapps' method of life and reindeer-keeping. It is very curious, however, that his travel diary, one of the

treasures of Swedish literature, was not published until 1811, when an English translation appeared under the title *Lachesis Lapponica*, or *A tour in Lapland*. It was not until 1889 that the diary was prepared for publication by E. Ahrling and issued in the original Swedish under the title used by Linnaeus, *Iter Lapponicum*. The original manuscript of this diary is one of the treasures in the library of the Linnean Society of London. Finally, a revised and annotated edition, giving modern scientific names, was prepared by Th. M. Fries, and was published in 1913. The diary is written in a naïve spontaneous style, illustrated by quaint little pen drawings and brilliant descriptions of the animals and plants he saw by the wayside. In addition one sees the warm interest taken in the most varied objects: particulars of the Lapps' economic circumstances, habits and customs, their various diseases, household details, and their language and sports. An extract from the first page of his diary describing the start of his journey illustrates the style in which it is written: "It was a splendid spring day; the sky was clear and warm, while the west wind refreshed one with a delicious breath. The winter rye stood six inches high and the barley had



Map showing the travels of Linnaeus' students
By kind permission of Mr. Willy Heimann
Sandbergs Bokhandel, Stockholm

newly come into leaf. The birch was beginning to shoot, and all trees were leafing, except the elm and aspen. Though only few of the spring flowers were in bloom, it was obvious that the whole land was smiling with the coming spring. The lark sang in the sky: Ecce suum tirile, tirile, suum tirile tractat. [Lo! it exercises its 'tirile, tirile,' its 'tirile,' *i.e.* an imitation of its song.] When about eight miles had been traversed, the woods began to increase. The sweet lark which has hitherto delighted our ears, left us, another bird, the redwing, taking its place, which sang its sweetest from the fir tops, emulating the nightingale, the master singer."

The 'Lapland journey' was the most important of his travels from the point of view of exploration, and had a profound influence on his subsequent career. One recalls a parallel example in Charles Darwin and the 'Voyage of the *Beagle*.' But although Linnaeus continued to retain a keen interest in exploration throughout his life and encouraged his students to journey to the ends of the earth in search of knowledge and to make natural history collections, his own travels were confined to Northern Europe.

In 1734 he was invited by the Governor to travel round Upper Dalarna and provided with ample funds for this purpose. His travel diary and *Flora Dalakarlica*, the results of this tour, again had to wait for publication until the nineteenth century. The following year he followed the practice of the few Swedish medical students of that time in going to Holland and joined the University of Harderwijk. During a visit

to Amsterdam he met George Clifford, a rich banker of English descent who had a botanical garden south of Haarlem. Through Clifford, he was given the opportunity of visiting England and met Sir Hans Sloane, President of the Royal Society, Philip Miller, the horticulturist of the Apothecaries' Garden in Chelsea, and Dillenius, Professor of Botany at Oxford. He subsequently went to Paris where he met the Jussieus, and was made a corresponding member of the Académie des Sciences. He also heard that if he would take French nationality they would appoint him a full member of the Academy with an annual pension. In spite of this and other offers Linnaeus returned to Stockholm in 1738 and was appointed Professor of Botany and Medicine at Uppsala in 1741. Subsequently he undertook three important journeys in Sweden on public commission; to Oland and Gothland in 1741; to West Gothland and the Bohus Coast in 1746; and to Skåne, in 1749. The reports of these journeys contain many observations on the agriculture, trade, and customs of the places visited, as well as their natural history and geology. They are a gold-mine for students of country life in Sweden in the middle of the eighteenth century. Previously, in October 1741, on being elected to the Chair at Uppsala he had chosen as the subject for his inaugural address "The necessity of travelling in one's own country." He spoke "not of the peculiar advantages of universities or of sojourning at this rather than any other foreign one; but chiefly of travelling in one's own country, thro' its fields and roads; a kind of travelling, I confess, hitherto little used and which is looked upon as fit only for amusement." He then refers to his own travels "into the forests of Dalecarlia, the groves of Gothland, the heaths of Smoland, and the unbounded plains of Scania. There is scarcely any considerable province of Sweden which I have not crawled through and examined; not without great fatigue of body and mind." Concerning travellers in general he states "We ought to travel in the flower of our age, while the mind, and the body are in vigour, while our strength is unimpaired, and alacrity at its height; before a family, household affairs, and conjugal ties have engrossed our affections."

He then discusses his own experiences in Lapland and other parts of Sweden and concludes: "But love to truth and gratitude towards the Supreme Being oblige me to confess, that no soc ıer were my travels finished, but as it were, a Lethaean oblivion of all the dangers and difficulties came upon me; being rewarded by the inestimable advantages which I reaped from these devious pursuits." Perhaps one may express a slight regret that for the remainder of his life such an eloquent advocate was prevented from undertaking any considerable journeys, for if Linnaeus had not become a "Prince of botanists" he might well have been a "Prince of travellers."

FROM THE *JOURNAL* A HUNDRED YEARS AGO

THE FOLLOWING extracts are taken from a "*Description of Vancouver Island* by its first Colonist, W. COLQUHOUN GRANT, Esq., F.R.G.S., of the 2nd Dragoon Guards, and late Lieut.-Col. of the Cavalry of the Turkish Contingent." It was read to the Society on 22 June 1857 and is printed in the *Journal of the Royal Geographical Society*, Vol. 27, pp. 268–9 and p. 320.

"The position and natural advantages of Vancouver Island would appear eminently to adapt it for being the emporium of an extended commerce. It contains valuable coal fields, and is covered with fine timber. The soil, where there is any, is rich and productive; the climate good; and the singular system of inland seas by which it is environed teems with fish of every description. Capable of producing those very articles which are most in demand in neighbouring countries, and offering, in its numerous safe and commodious harbours, almost unrivalled facilities for import and export, it would seem to require but a little well-directed exertion of energy and enterprise to make it the seat of a flourishing colony. . . ."

Here follows some fifty pages of description of the island

"The above hastily written sketch will be found to contain a tolerably exact account of Vancouver Island, etc., as far as it is at present known; the particulars given are all the results of personal observation, and the statistics may be depended on as tolerably accurate, if not precisely correct. It will be seen that Vancouver Island possesses in itself several resources, which, if developed by a free people, under free institutions, would tend to make it a very flourishing colony.

The high price of land, when equally good land can be got for one-fifth of the sum in Oregon, has prevented numbers of people from settling there, who were otherwise favourably inclined to do so.

In the spring of 1851, Mr. Blanchard came out as governor of the island; he remained little more than a year, when he resigned, being in very bad health. His loss was very much to be regretted, as he was a gentleman in every way qualified to fulfil the duties of his position, with credit to himself and with prosperous results to the country over which he was appointed to preside. The present governor has been very successful in his management of the native tribes, whom it is his policy generally to conciliate; on one occasion particularly when one of the Cowitchin Indians had shot a white man, he thoroughly effected the object in view, that of punishing the guilty for the outrage committed, without causing any unnecessary bloodshed.

A prison also has been built of wood.

The examples of Oregon and of California furnish us with proofs that the rapid growth of new countries is best fostered by giving scope and encouragement to the exertions of individual enterprise, and the progress of a country will be founded on the surest basis when that country shall have been settled by bodies of independent freeholders accustomed to rely on themselves for support, and when the benefit of free institutions shall have given to each individual an interest in the general prosperity."

OPERATION I.G.Y.

GUIDE TO I.G.Y. With a foreword by Sir James Wordie and contributions by members of the British National Committee for I.G.Y. *London: Methuen*, 1957. $8\frac{1}{2} \times 5\frac{1}{2}$ *inches; 48 pages; maps, diagrams.* 2s 6d

ONCE ROUND THE SUN. By RONALD FRASER. *London: Hodder and Stoughton*, 1957. $8 \times 5\frac{1}{2}$ *inches;* xv+160 *pages; maps, diagrams, illustrations.* 16s

REGARD THE EARTH. By RONALD FRASER. *London: Junior Art Club Publications*, 1957. $9\frac{1}{2} \times 6\frac{1}{2}$ *inches; 24 pages; maps, diagrams.* 2s 6d

THE UNITED KINGDOM CONTRIBUTION TO THE I.G.Y. 1957–8. *London: Royal Society*, 1957. $9\frac{1}{2} \times 7$ *inches; 72 pages; maps.* 10s

GEOPHYSICAL MONOGRAPH No. I. ANTARCTICA IN THE I.G.Y. Based on a symposium on the Antarctic, co-sponsored by the U.S. National Committee for I.G.Y. *Washington: American Geophysical Union of the National Academy of Sciences*, 1956. 10×6 *inches;* 136 *pages; maps and illustrations*

INTERNATIONAL GEOPHYSICAL YEAR: METEOROLOGICAL PROGRAMME. General Survey. *Geneva: World Meteorological Organization*, 1957. 9×6 *inches;* 108 *pages*

THE HALF-DOZEN books and brochures here reviewed are all concerned with the inception, plans and programmes of the International Geophysical Year, now in active progress. Three of them, 'Guide to I.G.Y.', 'Once round the sun' and 'Regard the earth,' are intended for popular reading, the first having particularly in mind the schools which will be following the project. Sir James Wordie, who is chairman of the United Kingdom National Committee, writes a foreword for this and for the third of them. Sophisticated sixth-formers will perhaps raise an eyebrow when they read in the 'Guide' (according to the Assistant Secretary of the Royal Society) that the Greeks called the Earth "geo," but such a slip is a reminder of the danger of the too early specialization of the scientist. It is a danger more deplorably illustrated in the case of Dr. Ronald Fraser, Administrative Secretary of the International Council of Scientific Unions, who writes the lively and otherwise admirable pair, 'Once round the sun,' and its companion, 'Regard the earth.' He opens and closes with the same long out-moded antithesis: "The age of the *geographical* exploration of the earth's surface is all but over. But the age of the *scientific* exploration of the earth is only beginning." Yet the geographer, whose objective is the integration alike of the physical and the biological data concerning the earth as a whole, is likely to be the scientist most appreciative of each and all of the diverse aspects and subjects of the Year's work, seen in their complex relationships, rather than as single specialities.

Dr. Fraser has chosen to write in a colloquial—indeed often a slangy—style. Halley, for example, "cadged" his youthful voyage to St. Helena! But he succeeds in conveying an atmosphere of excitement, of urgency, and the belief that we are really on the edge of important new knowledge. He devotes the first part of 'Once round the sun' to a sketch of the present boundaries of the known and unknown in various fields of science and the unanswered queries that confront us: puzzling phenomena of magnetism, of climate change, of the daily weather, the mystery of deep-sea currents, the meaning of new sun and earth relationships discovered in the ionosphere. "It was a complete surprise to the astronomers when the radio-scientists discovered that in its output of light in the far ultra-violet unobservable at the earth's surface, the sun is a *variable star*." Part II of the book describes how these various problems are to be tackled, considerable space being devoted to the proposed exploration of the upper atmosphere by means of rockets and satellites. This will, of

course, be the section of greatest interest to "the next generation," to whom the book is dedicated.

It is, however, amazing to note that despite all the publicity given, on the wireless and in print, to the proposals for an International Geophysical Year, the result has been to catch the interest only, yet not the comprehension, of the literary world. In the witty competition page of a well-known weekly, readers were asked to suggest a plan for an I.G.Y. in Gulliver's Laputa. Almost without exception they set the "philosophers" to work on experiments designed to achieve some supposed amelioration of the human lot—the moon was to be blacked out to stop the tides, a drug was sought to neutralize gravity, and so on. Such schemes as these were awarded the prizes, while so authentic and fitting a geophysical task as weighing the sun (against the yard-stick of the tan on a pretty girl) received a mere commendation. Dr. Fraser and the various specialists who prepared 'Guide to I.G.Y.' certainly do not take "usefulness" as a guide. They firmly assert the value of knowledge in its own right. The primary purpose of the Year is the search for knowledge, although undoubtedly aspects of this knowledge will prove of practical importance.

The general plan of the Year and the organization of the work proposed are set out in the preliminary sections of the Royal Society brochure, which deals specifically with 'The United Kingdom contribution to the I.G.Y.' The names are listed of members of the British National Committee, and of the various sub-Committees, among them those of Professors Gordon Manley and J. A. Steers, although geography as such is firmly ignored by the Royal Society. There then follows a list of fifteen so-called "scientific disciplines" which are stated to make up the programme for the Year. The term is not a happy one, for although it is correctly used of, say, meteorology, glaciology, oceanography, it is hardly applicable to World Days (the calendar for the Year), rockets and satellites, publications, or even longitudes and latitudes. The last-named are placed in the hands of the astronomers, and the results will have bearing on the shape of the earth, on the precision of time signals, and on the vexed question of continental drift. The measurement of lunar distances, the seaman's long-used method of fixing his position on the earth, will be given immense refinement by the use of a new moon camera which overcomes the rapid motion of the luminary by holding it against the stars. Information will also be gathered on the short-term oscillations of latitude and longitude believed to be due to the large-scale transferences of air and water masses to and fro over the globe. Here it is of interest to notice the increasing part played by chemistry in tracing the history of air masses and deep-sea currents. Oceanography and glaciology both come into the picture, and although the general public may regard as academic the new speculations as to the cause of ice ages which arise from our new knowledge of the sun, they will appreciate the possible calamities implicit in a general rise of sea level consequent upon the melting of glaciers and ice caps now in progress.

It is probably scarcely realized, except by those closely concerned, how coarse is the network of observing stations for scientific purposes outside the advanced industrial countries. The oceans are, of course, the worst served, and they cover the greater part of the globe. Moreover, the cost of placing and maintaining observers on uninhabited islands, however admirably situated, is quite prohibitive. Bouvet Island is a case in point. During the Year, however, there will be concentration on particular "blank spaces" including the inter-tropical belt and the two "frigid" zones. Antarctica, of course, is especially the object of research in every physical field, and the Royal Society's brochure gives a particular account of their Halley Bay Station. All the stations are listed for which the United Kingdom is responsible, their programmes and equipment being indicated by a series of initial letters, and their positions by geographical and (where required) geomagnetic coordinates; the latter are in relation to a notional magnetic axis with poles at 78° 30′ N., 69° 00′ W. and 78° 30′ S., 11° 00′ E. They are employed for geomagnetic, auroral and cosmic ray observations. The stations are also mapped, and it seems very inappropriate under the

circumstances to have chosen Mercator's projection without at least accompanying it with Arctic and Antarctic insets. Of the last-named area a fine map on the scale of 1/6M. drawn on a stereographic projection, has been furnished by the American Geographical Society, and is placed in a pocket of 'Geophysical Monograph No. I: Antarctica in the I.G.Y.,' a symposium sponsored by the American Geophysical Union. It has a 1 degree network as far as 75° S., a 2 degree (in longitude) between 75° and 85°, and a 5 degree to the Pole. The latitudes are at 1 degree throughout. But many of the specialists do not know how to use such a map. The writer on geomagnetic disturbances, for example, plots what he terms "an extraordinarily fine network" of observing stations on a small outline map from which the geographical network has been completely banished, and on which there is no indication of scale, projection or orientation. Not even the Pole is marked. Only in Palmer Peninsula (Graham Land), in fact, can the magnetic stations be considered close-spaced. Elsewhere fifteen stations must cover about 5 million square miles. The sketch-map of the location of reported earthquakes, too, covering the whole of the Southern Ocean, is likewise devoid of any scale, and of the network which would enable the sites to be identified, although in this case the South Pole is marked.

This American monograph provides a useful summary of Antarctic geography, followed by a short article on photogeography, defined as "the analysis and interpretation of airphoto images as a geographic research technique." Although laborious and often tedious, this method of geographical study can be very rewarding, and as the writer makes clear, it is one of peculiar importance in an area, such as Antarctica, of extremely limited accessibility. Nevertheless, conditions of light and weather, as well as the nature of the snow-covered surface itself, make Antarctic air-photography very difficult.

The last of the six publications under consideration here is the 'Meteorological programme' issued by the World Meteorological Organization. It is for the most part devoted to detailed information necessary for directors and observers engaged on the scientific work. The general reader will, however, be interested in the programme itself, and the geographer particularly in what is said about two of the major problems appearing under dynamic meteorology—namely the investigation of the large-scale influence of friction and surface topography, and that of the heat and momentum exchanges between the atmosphere on the one hand and the continents and oceans respectively on the other. Among the conclusions reached by H. H. Lamb in his study of Antarctic meteorology (*Geogr. J.* 121 (1955), pp. 334–49) was that undiscovered geographical features—crests, depressions, valleys—probably held the key to the many anomalies of weather, including the locally violent gales, that are met with on the margins of this great continent.

Anyone studying the preliminary literature of the International Geophysical Year cannot fail to feel concern as to how the enormous mass of observations collected by observers of fifty-five nations is to be recorded and made available for use. Vice-Admiral Sir Archibald Day has been appointed Coordinator for the I.G.Y., and in a recent article (*Journal of the Institute of Navigation*, 10 (1957), pp. 249–53) he explains that it is planned to have two or possibly more complete master sets, which will presumably be safely stored in opposite hemispheres, while there will also be centres for each of the "disciplines" which will hold complete sets for their particular subjects. All disciplines will have centres in the United States and in the Soviet Union, while a third complete set will be found in Western Europe taken as a whole, Great Britain will provide centres for ionosphere, aurora and glaciology. Admiral Day's office is now actively engaged upon a 'Guide to I.G.Y. World Data Centres.' It is inevitable that, in a vast scheme involving so many individual organizations and so many fields of science, advantage should have been taken of the modern shorthand of initial capital letters: "A detailed scheme has been prepared by W.M.O. at the request of C.C.A.G.I. for the dissemination of S.W.I. messages." "This important question was studied by the I.G.Y. working group of the I.A.M., by the I.G.Y., and

by C.S.A.G.I." The Royal Society brochure gives a useful glossary of such contractions, which are also employed for programmes and equipment, and this example should be followed.

It is of interest to compare the present plans and outlook of geophysicists with those of over thirty years ago, when Dr. (now Sir) Harold Jeffreys published his brilliant book entitled 'The Earth.' He was concerned mainly with applying mathematical reasoning to current theories about the crust and interior of the earth, and to speculations and hypotheses about isostasy, the origin of major surface features, and climate change. Some of his conclusions raised a storm among geologists, who declared they would not be deterred from holding an opinion just because it was deemed mathematically unsound. But what is of relevance here is that the index of 'The Earth' contains no such words as aurora, airglow, ionosphere, cosmic rays, geomagnetism, which are to play so large a part in the International Geophysical Year. Nevertheless in reviewing the hypotheses advanced concerning climate change, Jeffreys considered that changes in solar radiation could not be ruled out, for the simple reason that we knew nothing about them. Changes in the amount of carbon dioxide in the atmosphere he did reject, so it is startling to read a recent statement of Sir Harold Spencer Jones that in fifty years' time our coal- and oil-burning habits will have increased the present content of that gas by 70 per cent. The "greenhouse" effect that it produces will lead to a general warming of the atmosphere, and this will presumably accelerate the retreat of glaciers and ice sheets and increase the consequent rise in sea level. That is to say, it will do so unless in fact the CO_2 is removed by dissolution in sea water. Its behaviour is therefore being watched. Dr. Jeffreys also expressed his mathematical opinion of continental drift—it was "out of the question." But today new arguments are being adduced from the geomagnetic study of the rocks —there is found a trans-Atlantic fit! Truly these are great days for those eager for knowledge in its own right.

E. G. R. TAYLOR

CHARLESWORTH'S 'QUATERNARY ERA'

THE QUATERNARY ERA. By J. K. CHARLESWORTH. *London: Arnold*, 1957. 2 volumes. 9×6 *inches;* xlvii, xxix, *and* 1700 *pages; maps, plates, diagrams.* £16 16*s*

IT IS SAID that the students of a certain university were instructed, by way of examination, to write all they knew, and that they were still so engaged some years later. Professor Charlesworth, limiting himself to the Quaternary Era, has just emerged after thirty-five years with a staggering work in two volumes and 1700 pages, beautifully printed and illustrated, and well bound. Nothing comparable with it has been published on the subject in this country since the appearance of W. B. Wright's 'Quaternary Ice Age,' a milestone in the progress of these studies. Ireland is a fortunate isle that she has produced two such authors, and it is impossible to think of the new work without remembering its precursor. Charlesworth's book is global in its outlook, and students in this field can no longer complain of the lack of an adequate reference book. It is certain that so much learning could not have been put into a smaller compass at a lesser cost. These two large volumes weighing over 8 lbs and costing together sixteen guineas present their own problems to the ordinary reader: but no library that professes to deal with the subject can afford to be without them.

The work is divided into three parts: the first, glaciology (land and sea ice), and the second, glacial geology (glacial erosion, glacial deposition and periglacial geology), together form Volume I; the third, Quaternary geology, makes the greater part of Volume II, which is much the larger. There are thirty-two plates, of excellent quality,

and 326 illustrations in the text, commendable for their clarity and execution. The subjects considered in successive chapters are amplified by most impressive lists of references, and there is a huge bibliography following Part III in Volume II.

In an attempt to analyse this monumental work the writer has decided, for the purposes of the *Journal*, to note and review primarily the author's contributions to physical geography, to put less emphasis on Quaternary geology, and to omit entirely trivial points of criticism.

Volume I: Part I, "Land and sea ice," has an introductory chapter on snow and its distribution, which drives home how involved is a conception of the snow line. Certain significant laws are then shown to emerge on a world-wide basis, with particular reference to North America, the North Atlantic lands and Europe. The chapter is a good example of the thorough treatment of a subject often dismissed in a few lines, of value to geographers rather than to glaciologists. The following chapter, on form and structure of glaciers and on ablation, will be read critically by glaciologists, who must allow that some of their studies are advancing fast and without unanimity. The author stresses the importance of increasing specific gravity, deals fairly with the problem of the mutual relationship of grains, and gives examples of results obtained from pits and bore holes; banding and the factors governing ablation are discussed and there is a useful general account of the thicknesses of land ice. The two chapters, taken together, are a fair sample of observation and theory; there is no attempt to be exhaustive, despite the hundreds of references to literature, some of them scarcely three years old.

The chapter on classification and distribution of land ice contains an agreeable amount of historical material, covering both exploration and literature, of regional description, and of attempted classification. The emphasis here is morphological, from "sheet ice" on elevated ground, through glaciers to "transition ice" (shelf ice to icefoot). Some terms are used in senses which may be unfamiliar, and the subdivision of glaciers, a little reminiscent of W. H. Hobbs, may be thought to be unrevealing, if descriptively truthful. It is a difficult subject at the present time and criticism is all too easy, so the writer passes with anticipation from rather arid, if geographical, description to the exciting topic of ice motion. A brief but attractive historical review of measurement and laws governing movement opens the chapter; it should command the respect of glaciologists and physical geographers. The author concentrates on known, observational, facts, and shows that, in spite of "laws," glacier flow is highly individual. He then passes to consider yearly and seasonal temperature waves, and the recognition of "warm" and "cold" glaciers. The second part of the chapter is devoted to theories of ice motion—structure and physical constants, sliding, dilatation, plasticity, translation, regelation, granular theory, glide planes—ending with a consideration of Finsterwalder's theory, and an application of the whole to the flow of Pleistocene ice sheets. To the writer, the chapter seems full of wise and objective thought, a model which will remain up to date in spite of further work; it deserves a full review of its own, with its phenomenal and world-wide bibliography.

Next, the author launches courageously into the troubled sea of meteorological and glacier oscillations. The first part of his chapter is headed laconically "Brückner and other cycles," and goes on to sun spots. Every type of evidence seems to be mentioned in astounding array and variety, and the seeker after truth gets more common sense in a few pages than the writer has read on the subject for some time. Glacier oscillations—seasonal, periodic, secular, seismogene—are treated with a wealth of examples from the author's fantastic store of historical to last-minute knowledge, and his refusal to jump to conclusions must command the respect of any reader. He reviews the present regression on a world-wide basis, and discusses the cause of oscillations in a detached and objective manner. The references in this chapter number nearly six hundred. Part I ends with chapters on shelf ice, ice tongues and icefoot, and on drift ice (icebergs, sea ice, lake and river ice). These are subjects on which our knowledge is growing rapidly, and the system here seems a little artificial;

the pages devoted to icebergs seem to the writer to be particularly useful for the general reader.

Part II, "Glacial geology," which occupies some 380 pages, is divided into three; glacial erosion, glacial deposition, and periglacial processes. Analytical study demands the separation of the first and second, but, up to a point, it is the method of the lecture room. We find, therefore, a discipline which the author obeys, and no doubt imposed on his students. First, glacial erosion: he states the general problem, which involves him inevitably in questions of deposition because he wisely emphasizes that ice first scrapes off preglacial soils and rock-debris. He concludes (p. 231) that ice has remodelled, rather than created, relief: a chapter full of wisdom. Next, in pages which are packed with information and shrewd observation, he makes a timely case for the erosive power of subglacial streams, noting their significant canyons. He stresses the plucking action of glacier ice on coherent rocks and the profound glacio-static disturbances of soft or incoherent material. The glacial origin of rock basins, of the subalpine lakes, of the Baltic and the Great Lakes, receives considerable attention, and the author goes on to discuss the much debated nature and origin of cirques; he concludes that they owe their floors to ice abrasion and their walls to plucking of various types, which is not as simple and obvious as it seems. In a long chapter he expounds the preglacial origin of U-shaped valleys, and their glacial modification, and reminds his readers that Penck recognized that glaciers operate mainly in modifying pre-existing features created by running water. But that does not deny that transfluence and diffluence take place. He remarks, as others have said, "the Colorado Canyon, if glaciated, would present all the features of a typical U-valley." Fjords naturally receive attention at this point, the evidence is well and fairly cited, and the author decides that "fjords were probably originally deep and wide canyons with short spurs and hanging valleys resulting from Tertiary rejuvenation." He marks their modification by moving ice, and the unimportant accident that they are now flooded in varying degree. Fjärds and föhrdes are briefly discussed.

Turning to glacial deposition, the author first establishes a classification. He then has a delightful chapter on erratics, an *omnium gatherum* of bizarre and instructive examples, followed by another on boulder clay, in which he recalls the recognition long ago of parallelism of major axes of boulders in the till with the striated surface below it: he also discusses englacial and subglacial origins of boulder clay. Succeeding chapters on drumlins, and their unsolved problems, and on the classification and description of moraines, in the main descriptive, are full of good material. The scholarly chapter on eskers (kame terraces, kame moraines and osar) is a model of careful statement and discussion, but on the whole no overwhelming advance seems to have been made since W. B. Wright's day.

A lively account of valley trains and outwash plains brings the vexed question of the alpine schotters up to date, and is well illustrated from the works of Troll and others. The author provides a substantial chapter, with 524 references, on glacio-lacustrine and glacio-morainic deposits; subjects often sketchily treated, but here portrayed with enthusiasm and vivid detail, with realistic accounts of catastrophic outbursts of flood water in Iceland, in alpine valleys, in the Himalaya and elsewhere, and with more prosaic descriptions of lake beaches, drainage channels and the great Pleistocene glacier-lakes. The section ends with a fine chapter on the glacial effect on scenery, including cultural influences and a brief account of post-glacial readjustments.

Volume I draws to a close as refreshingly as it begins, with a section of three chapters on periglacial processes. The author surges on with tireless zeal, intimate and apparently inexhaustible knowledge, and a ready pen. His chapter on that most provocative subject, loess, is in the writer's opinion a model. The classic data and opinions are there; the northern hemisphere is well covered; South American loess of the pampas takes its place; chemistry, grading, malacology, wind directions, soils, dunes, receive their due; the Aeolian origin of loess is deduced, but not assumed.

A student could not be better served, and if he follows the 709 references that end the chapter he should have a good working knowledge of the subject.

The next chapter is entitled "Cryoturbation," to cover those subjects now so much to the fore, and generally served rather poorly in text-books, namely permafrost, ground ice, solifluction, polygonal markings and blockfields; lake-ramparts, river ice and avalanches are included in the same chapter. The author gives us a feast of reason and debate which is worthy of a critical review of its own. A neat four-page chapter on the geological action of sea ice, though full of good sense, is an anticlimax which probably amused the author's literary soul. So ends Volume I.

Volume II: So far the author has studied active processes. Now he seeks to apply that knowledge to the past. Part III is primarily a vast compendium of Pleistocene meteorology and climatology, palaeontology, culture, stratigraphy and palaeogeography, leading to correlations of sequences and of faunal migrations. There is a final chapter on the cause of the glacial period. The bibliography for the two volumes follows; it includes 1924 items, but excludes incidental references given at the ends of chapters. The author has striven to make reference easy, but the total amount of literature which he has mentioned is so huge that any system must prove cumbersome. A general index, in double column, occupies eighty-three pages, which speaks for itself. Finally, a systematic index is a boon to any serious worker.

The writer has much difficulty in assessing Part III, "The Quaternary Era," in so far as it directly concerns geography. He would find the task easier for a geological journal. For present purposes he thinks that the stratigraphical and allied material should be read by geographers with reservation: Pleistocene stratigraphy, even of "classical" sections, is temperamental, sometimes subjective, and correlation, especially over great distances, demands faith. One believes, and worships at some shrine, or one is agnostic and yearns for ultimate truth. The author gives the words of the prophets, and new prophets show the errors of their precursors as soon as the page proofs leave the author's hands. This is true of any writing, but here elaborate and erudite regional sequences destroy, if they prove to be ephemeral, dependent wider correlations which are therefore singularly unstable (and bitterly defended by their creators). Perhaps it is fair to say that it is all in Part III, splendidly compiled and woven into beautiful narratives by the unrivalled master, a man of perception and proportion; that it looked like that when he passed the page proofs, and that much of it will still have the same appearance in several years' time. These remarks are in no sense a criticism of the author, but they do imply that first, Part III will be most appreciated by those who work in that field of studies; secondly, if we wish to enter seriously any part of that field, we should start where the author started, namely from first principles, and we may accept his guidance; thirdly, casual readers should not regard correlation tables as immutable continental, or intercontinental, Bradshaws.

Certain chapters seem to the writer to be particularly welcome for the general reader, because they deal with subjects, often overlooked, immediately related to the environment of the present day. Thus a chapter on Pleistocene life deals with the environments of plants, invertebrates, and especially mammals, the warm (southern) fauna, the mammals of steppe, tundra and alpine zones. Later, migration with changing climates, relicts and survivals, re-immigration of life into glaciated regions, and post-glacial climatic changes, bring the record of climates, plants and animals to the threshold of the times in which we live. These subjects, so dear to the author, and to a great school of Irish savants, catch the reader's imagination however steeped in them, or ignorant of them, he may be. To the writer they make Part III a living thing, and cause him to close Volume II with regret. 'The Quaternary Era' is more than an impressive text-book, it is a human document.

K. S. SANDFORD

THE SWISS ON EVEREST AND LHOTSE

THE EVEREST–LHOTSE ADVENTURE. By ALBERT EGGLER. Translated by H. Merrick. *London: Allen and Unwin*, 1957. $8\frac{3}{4} \times 5\frac{8}{4}$ *inches; 222 pages; maps and plates.* 21*s*

THE SWISS WHO climbed Everest in 1956 would be the first to admit that they benefited from a number of advantages which their countrymen did not enjoy four years earlier. Among these were the developments in the realm of equipment: the great improvements in the oxygen equipment comes foremost to mind. There can be no doubt, also, that the provision of cooking stoves which functioned perfectly at high altitude had effects which, by their lack in 1952, were one of the main reasons, psychological as well as physiological, for the failure of the Wyss-Dunant and Chevalley parties. Of even greater importance, however, in computing the merit of Eggler's team, were certain human factors. Here was a group of men, homogeneous both from its origins and by a long previous preparation for the task; homogeneous too, in its attitude towards that task. From the beginning, this Swiss expedition looked like a united party, setting out to achieve its aim *impersonally*; the standards of experience and skill were uniformly high, but there were no pre-destined summit *stars*. But greater than any other single advantage available to Eggler, was the simple knowledge that it had been done. This factor, in my view, transcended all the other benefits which this expedition had inherited from the past; it is the factor which will make the ascent of Everest progressively easier as time passes.

To say all this might sound ungenerous if the remainder of the truth were left unstated. But the essential fact remains that the Swiss achievement was magnificent and astonishing. Never before has one expedition climbed two summits of the order of 8000 metres. This, and the fact that Lhotse, fourth highest summit in the world, was climbed for the first time by this party, gives them a unique distinction. Another distinction was the reserve, and therefore the safety, with which they achieved both ascents. Both these facts speak worlds for their stamina, skill, unity and also for superb planning. For the planning, all members of the expedition can take a share of the credit; they had been together during the whole of one year before starting out, and each had taken his part in the preparations. Particular praise is due to Eggler himself, and to the Swiss Foundation for Alpine Research. Following our experience in 1953, they realized one very fundamental point: the need, from the outset, to establish a plan, theoretical in our case and flexible in both, for reaching the top and returning to the advance base. From this plan, or planning basis, all detailed decisions regarding equipment, food, and not least the size of the party itself, would stem. More important still, a full understanding of the plan, and conviction regarding it in the minds of every member of the party, would be a deep-seated psychological factor, with incalculable effect on the ultimate result. This, combined with his leadership—cool, quiet, good-humoured—I attribute to Albert Eggler.

There are many points in the story of special interest to those of us whose plans and progress were so closely paralleled by the Swiss. The use of a winch on a part of the Lhotse face had earlier been carefully investigated by Bourdillon, and finally rejected by myself owing to weight. And there was the difference between our oxygen equipments. The Swiss followed the highly successful design of the French Makalu expedition; its efficiency undoubtedly accounted to some extent for their much better performance at high altitude, particularly so because with one exception they had never climbed in the Himalaya before. I found interesting—and difficult to understand—the continued Swiss preference for using the "Yellow Band" on the Lhotse Face, instead of traversing above it from the top of the so-called Lhotse glacier.

But I come back to the human element. I marvel at the fortitude of that first

summit party, consisting of Schmied and Marmet who, after a terrible night at 27,550 feet, buried in their tent under new snow, unable to extricate their food and cooker, decided to set out in a gale and without food. They went, not as might have been expected, down to the South Col, but for the summit. Only those who have had some comparable experience, particularly of high wind at high altitude, can fully appreciate this decision. It would be easy to attribute it to anoxia, but for the fact that their oxygen sets were functioning perfectly. Indeed, there is no explanation but a very great comradeship and courage. It symbolizes the whole manner of the Swiss triumph.

JOHN HUNT

REVIEWS

EUROPE

THE SOILS OF THE GLASTONBURY DISTRICT OF SOMERSET. Sheet 296 : Memoirs of the soil survey of Great Britain. By B. W. AVERY. *London: H.M.S.O.*, 1955. 10×6 *inches;* iv+131 *pages; map and diagram.* 15*s*

This memoir presents an admirably clear and compact account of the soils of an interesting and diversified area, including a small part of the southern fringe of the Mendips, a belt of ground on the Liassic and oolitic rocks, south of the latter, and the great alluvial expanses of Kings Sedgemoor and Brue Level. There has been no 6-inch revision of the geology of this ground, so no modern detailed geological map is available. The soil map here presented thus affords the only approach to the surface geology.

The memoir includes a valuable chapter on "Soil mapping and classification." The mapping unit here, as elsewhere in England, has been the Soil Series, replaced by the "soil complex" where two or more series are so closely intermingled that accurate delimitation of their boundaries is impracticable. Thirty-three series or complexes are distinguished, but of these *three* (the Evesham, Somerton and Sedgemoor Series) cover nearly 40 per cent. of the area, while the last ten units listed account in all for only about 3000 acres. A particularly welcome feature is Table IV which refers the series to their geological parent material. The series are also assigned to their Major Soil Group "Brown Earth," "Calcareous," "Gley" or "Organic." It must be a major preoccupation of soil science in Britain to devise such groupings by which the patchwork of the series map can be seen in its broader patterns. Yet any such broader grouping requires that the series should first be distinguished—the principle of classification must be by grouping the species, not by sub-dividing the genera.

The area is notable for the earlier investigation of the "teart" (*i.e.* sour) pastures which were shown by D. A. Osmund to be confined to calcareous soils on the Lower Lias, the toxic agent being shown by Ferguson, Lewis and Watson, to be molybdenum. This is a good example of a specialist investigation in pure chemical pedology, such as may sometimes precede, but is not independent of, the progress of actual soil survey. In a sense, it is probably true that the laborious work of defining and mapping soil series defers attack upon fundamental pedological problems as yet unresolved. The problem is of course exactly analogous in the case of geological survey. The demand for maps, for practical purposes, must give *mappability* a certain priority over interpretation. Yet in both cases the mapping is fundamentally precedent to full interpretation. There is the further question, of the reader to whom the maps and memoirs are conceived as addressed. In the present case it is fair and true to say that the account is well suited to the needs and interests of the geographer; it constitutes

indeed an important contribution to the study of the regional geography of the country. S. W. WOOLDRIDGE

CONCEALED COALFIELDS. By L. J. WILLS. *London: Blackie*, 1956. 9½×7½ *inches;* xiv+208 *pages; maps and plates.* 40*s*

It has long been recognized by geologists that in Upper Carboniferous times a large area in the middle of England—roughly from the "Aire Gap" to Warwick and Leicester, and from the edge of the Welsh massif to an unknown eastern edge in Lincolnshire or perhaps beyond—formed a geosynclinal, with its centre probably in south-east Lancashire, in which great thicknesses of coal-bearing measures accumulated. It has similarly been recognized that another great area of coal formation lay south of the Welsh massif and of the "Midland Barrier," in the South Wales–Bristol area. Apart, however, from a few classic studies such as the Geological Survey's memoir on the "Concealed Coalfield of Yorkshire and Nottinghamshire" there has been little co-ordinated effort to study the possible underground extent and accessibility of the coal-bearing rocks, and Professor Wills has performed a great service in presenting in coherent form, and richly illustrated by large sketch-maps, the results of many years of painstaking research.

The existence of productive coal measures depends both on the boundaries of the area in which the original swamp-forests grew, and on the earth movements which have subsequently raised or depressed the measures, resulting in erosion here, and burying there. The economic availability of the coals depends partly on earth movements and largely on the thickness of the barren upper part of the Coal Measures sequence and of the ensuing Permo-Triassic series. Professor Wills's study is thus concerned with the detailed reconstruction of the palaeogeography of the Coal Measures and Permo-Triassic periods. The history is divided into periods of relative stability (called "Palstages") separated by periods during which palaeogeographical changes were brought about by tectonic movements of greater or less extent (called "Palevents"). Five Palstages are recognized, separated by four Palevents, with two further Palevents, one which ushers in the Coal Measures after the Millstone Grit, and another which ends the Triassic with the Rhaetic marine transgression.

The main coal-bearing rocks in all the coalfields in question occur beneath the horizon, widely recognizable in Britain and on the Continent, known as the "Aegir" Marine Band (the Mansfield Marine Band of the East Pennine coalfield, the Cefn Coed of South Wales). The account of these—for the literature is abundant—occupies but one chapter, and the bulk of the book is concerned with the "supra-Aegir" measures (the upper part of the Middle Coal Measures of older classifications) and with the thick series of mainly semi-desert red measures which span the time-gulf between the Middle Coal Measures and the Keuper. It is a fascinating story, though full of hypotheses, doubts and queries; and Professor Wills has been very careful to distinguish between the proven, the conjectural and the purely hypothetical. The relevant literature is quoted in footnotes, and there is a bibliography. It is not easy reading by any means, unless the reader already possesses a considerable knowledge of Midland geology.

The detailed stratigraphical survey, much of which amplifies Professor Wills's earlier work on the "Palaeogeography of the Midlands" (1948), is followed by several chapters (forming Parts II and III of the book) which summarize the distribution and accessibility of the concealed coalfields, and two large folding plates put the whole into cartographic form. The whole study is an admirable piece of scientific deduction, leading from the known to the unknown. The author would be the first to admit its deficiencies—as he does on the last page—and doubtless his conclusions will not all be acceptable to all geologists; but at least it is an honest attempt by an acknowledged master in the field of Carboniferous geology, and it is withal very well produced. The palaeogeographical and isopach maps—all from Professor Wills's own pen—are models of clarity, yet packed with relevant detail. S. H. BEAVER

ROMAN ROADS IN BRITAIN: II. North of the Foss Way–Bristol Channel (including Wales and Scotland). By IVAN D. MARGARY. *London: Phoenix House*, 1957. 10×8 *inches;* 288 *pages; plates and maps.* 50*s*

Widespread approval greeted the appearance, in 1955, of the first volume of Mr. Ivan Margary's survey of 'Roman roads in Britain,' in which he described roads south of the Foss Way–Bristol Channel. Now comes a worthy successor in his second volume, which completes his account of roads north of that line, including those in Wales and Scotland. The second volume is more extensive than the first, containing not only a topographical description of the roads covered, but also sections on the development of the Romano-British road system, on milestones, on constructional details, on the finding and recording of Roman roads, and on future work, along with an appendix on the British part of the Antonine Itinerary, a Roman road-book of about A.D. 200. There are twenty-four plates (the best being from Dr. St. Joseph's air photographs), six excellent maps, a set of road sections, and a folding map. The system of road numbering so cleverly devised for the first volume has been applied with equal success to the even more complex road network further north.

In tracing and rediscovering Roman roads, Mr. Margary sweeps the reader along with him at a rapid and at times breath-taking pace, pointing out either actual remains of the roads, or their lines as now preserved by straight stretches of modern roads, lanes, tracks, hollow ways, stone walls, or hedgerows, or even by rows of telegraph poles, or, less tangibly, by parish boundaries or by place-names like Stratford, or most wonderfully of all, on air photographs. Although the journey is made at speed (the 6500 miles of Roman roads covered in the two volumes involved 19,000 miles of motoring), there is time to pause over some of the most spectacular features of the Romano-British road system, like the paved stretch of road on Blackstone Edge, or the Stanegate with its lonely milestone, or the bridge abutments in Wales and northern England, or the quarry pits in south-west Scotland from which road metal was dug by Roman pioneers.

Like the Romans who travelled these roads before him, Mr. Margary sets foot on less well-trodden ground when he penetrates the fastnesses of Wales and Scotland, and the reader who is familiar with the Roman remains of these two countries will find himself at times out of step with the author. For example, Mr. Margary refers to a Roman signal station at West Plean, Stirlingshire, which has recently been proved by excavation to be an Iron Age dwelling site, and he dates the recall of Agricola from Scotland to A.D. 81 instead of to about A.D. 84.

Such rare inaccuracies, and a very few printers' errors, do not, however, detract from his remarkable achievement in completing such a comprehensive account of the Romano-British road system. Admirers of the Romans who conceived, planned, built and developed this elaborate road system, and of Mr. Margary, its worthy exponent, must hope that he will follow up his general account with more regional investigations like the study he has already given us of 'Roman ways in the Weald.'

ANNE S. ROBERTSON

WHEATLEY RECORDS 956–1956. Edited by W. O. HASSALL. *Oxfordshire Record Society*, Vol. 37, 1956. 9½×6½ *inches;* 200 *pages; maps and plates.* 25*s*

This volume was produced by the Oxfordshire Record Society to mark the thousandth anniversary of a surviving document about Wheatley. The book is primarily a collection of documents concerning the one parish of Wheatley, a village 6 miles east of Oxford, but the work clearly demonstrates the varied sources that are available for writing local history. While not intended to be geographical in character the volume, nevertheless, includes much geographical information.

The introduction gives some account of the physical background of the development of Wheatley and describes the complex history of the relationship between changes in the roads and the pattern of the village. However, the most valuable part of the book for a geographer is the essay on "The archaeology of Wheatley stone" by

Mr. E. M. Jope. There was a local stone industry in Wheatley long before medieval documents became plentiful; there is no recorded mention of quarrying at Wheatley before 1286. But Mr. Jope is able to prove, by archaeological evidence, that stone from quarries near Wheatley was being used in Roman and in later Saxon times; and also that it was being used and transported over considerable distances during the eleventh, twelfth and earlier thirteenth centuries. The Wheatley industry appears to have declined into insignificance after 1400 in the face of the competition of the Headington quarries. Mr. Jope includes an interesting map of the distribution of the use of fine building stone of the Wheatley type in an area about 30 miles around Oxford. He states that "the chancel of Merton College chapel, Oxford (1290–4), is the earliest structure in the region for which any building accounts survive, and these show that it was largely built of stone from Wheatley." But Merton appears to have taken very little stone from Wheatley for building after 1315. It is suggested that Headington took Wheatley's place as the main source of Oxford's building stone during the fourteenth century. Nevertheless freestone from Headington has proved far less durable than that taken in earlier years from Wheatley. Mr. Jope believes that "Oxford builders would have done better to remain faithful to Wheatley freestone at the cost of a few extra miles cartage, though had they done so the reserves would soon have been exhausted." The appeal for funds made in 1957 by the University and Colleges of Oxford for the repair of their historic buildings is an interesting commentary on the history of quarrying.

The Wheatley quarries were still worked for tombstones in the early nineteenth century, and later only for agricultural lime, but local stone was used by G. E. Street, the architect of Wheatley's new church in 1856. The volume contains an interesting collection of facsimile documents and maps, including early estate maps, and a redrawing of the enclosure award plan of 1809. While much of the book's contents are purely of local interest, the work does illustrate the wealth of material for historical geography that is still available in England. E. W. GILBERT

SEVEN DESERTED VILLAGE SITES IN LEICESTERSHIRE. By W. G. HOSKINS. From *Trans. Leicestershire Archaeological Society*, 32 (1956), pp. 36–51. 3*s*

This reprint is a footnote to the much longer Leicestershire studies of Dr. Hoskins. It takes its origin in the enterprise of the archaeology division of the Ordnance Survey which "in the course of revising their 25-inch maps made detailed plans on that scale of seven village sites in East Leicestershire." The plans indicate in hachured form the visible evidence of the earlier village side by side with the present-day lines of communication and building pattern. Common to most of these clayland sites, with their fairly rectangular street plans and scatter of ponds, is a moated area. The maps lack contours, though indication of height is sometimes given in the text. In some ways, the most interesting feature shown is the boundary of ridge and furrow in relation to the village site. Why does ridge and furrow halt at the margins of these deserted settlements? The text which follows the introduction consists of a short, formal statement of historical references to each site. It does not attempt interpretation, for none of the sites has been the subject of field investigation. Drawing upon the evidence of the Wharram Percy excavation, Dr. Hoskins emphasizes "the complexity and irregularity of the sequence of houses on the same site." This is the sort of little book to encourage enthusiasts to match documents by digging among "the crofts and tofts of vanished farmsteads." It is also further indication of the distance travelled in local archaeological circles since our antiquarian forefathers were turning over tumuli. W. R. MEAD

THE WONDROUS ISLE OF STAFFA. By DONALD B. MACCULLOCH. *Edinburgh: Oliver and Boyd*, 1957. 9×5½ *inches; 205 pages; map and illustrations.* 18*s*

The second edition of this book was reviewed in *Geogr. J.* 85 (1935), p. 276. For this new edition there has been considerable revision of the text, and an additional

chapter added. It is unfortunate that a title more suitable for the pictorial and less informative sections of topographical literature has been retained. The author has presented an exhaustive and scholarly study of what is known of the island's geology, ecology, and place in the history and folklore of this Hebridean sea area. The text is supplemented by an excellent collection of photographs.

The first part of the book recounts the "discovery" in 1772 by Sir Joseph Banks and the second chapter, which is new, provides an interesting discussion of the difficulties which the early traveller encountered on his visit. Indeed it may be said to have been a pilgrimage, for such was the awe and respect that the first visitors and especially the Victorian tourists, had for the island.

The author has family connections with Staffa and has been able to make frequent visits and to explore it thoroughly. It is pleasing to find that information has been collected about the less well-known caves. Not only this, but an explanatory description is attempted for all aspects of the island's character and it is this feature of the book that should appeal to the geographer. Special attention has been paid to the geological evolution of the island and there is a very full treatment and summary of the theories accounting for the columnar formation of the basalt. The lack of a geological map and of sections illustrating the relationship of Staffa to the geology of the Hebridean area as a whole is an unfortunate omission and a more general map of this area would be helpful to the critical reader. The latter part of the volume records the comments of famous visitors to the island. One cannot but admire the prudence of the unknown visitor who claimed that his wishes made at the Wishing Chair had always been fulfilled. His request was for a safe return to Oban!

R. H. JOHNSON

THE COMMON LANDS OF HAMPSHIRE. By L. E. TAVERNER. *Hampshire County Council*, 1957. 10×7¼ *inches; 123 pages; plates and maps.* 21*s*

This book, written by an academic geographer for the Hampshire County Council, should be welcomed by everyone interested in either Hampshire or the question of common lands in general. Intended to be the basis of the council's evidence to the Royal Commission on Common Lands, it contains a vast amount of information, much of it tabulated, which might otherwise be difficult to come by. It will probably be appreciated mainly as a reference book, but it remains readable despite the heavy load of figures and quotations. The author explains what common land is, lists the numerous rights of common which exist, and gives a brief history which deals admirably with the essentials of the enclosure and preservation movements. He then describes the present position in detailed accounts of the rights on major commons in the different administrative divisions.

The accounts of individual commons make fascinating reading, but the analysis by administrative areas is quite inadequate as a setting for the next chapter in the story of common land. Admittedly, the development of that story will depend on the recommendations of the Royal Commission after consideration of this and other evidence. But one inevitably raises the question, and the book offers no solution. A hint of the way things might go is contained in the list of legislation concerning commons. This shows that early acts were primarily concerned with making better material use of the commons. Then after 1865 the keynote was preservation of amenities, until about 1930 when the emphasis once more tended towards economic aspects. But if the possibilities of continuing this trend are to be considered by the Royal Commission, then a much more comprehensive analysis will be required than is attempted in these pages. For example, despite a scholarly account of soil characteristics on the geological formations where commons mainly occur, there is no analysis into groups by geology or any other physical, economic or social criteria. Some broad grouping at least should have been attempted, even though the author's sources were inadequate for the kind of detailed analysis which will be essential if we are to get a satisfactory solution to the problem of common land.

It is easy to criticize this work for not going far enough, but not for its actual content. The merest glance through the book suffices to show that the problem is most complex, and Mr. Taverner has competently taken the first steps towards dealing with it. It is worth noting here that information on many subjects is regularly being collected by Ministry and Planning Authority staffs throughout the country, which, like this on common land, would be admirable raw material for further study by persons not enjoying such good facilities for survey work. All credit, therefore, to the County Council for publishing this work. But it must be emphasized that there is little besides raw material.

NORMAN HILTON

MAP OF GREAT BRITAIN: Limestone, including Chalk. 1 : 625,000. *Chessington: Ordnance Survey*, 1957. *2 sheets* 31½×40 *inches. 5s each, and text 9d*

This map of Great Britain showing limestone (including chalk) is, in the words of the text which accompanies it, "one of a series showing the general relationship between the production and uses of mineral raw materials and the geological formations from which they are won." The outcrop areas which are shown by colours according to their geological horizons are sometimes much more restricted than the formations in which they occur as shown on the 10-mile map of Solid Geology. This is because other rocks interbedded with the limestones, and areas unworkable on account of a thick covering of drift have been excluded wherever the information available and the scale of the map allowed. But on the other hand there are a few places where they are a little more extensive, as in Norfolk where the Pliocene deposits around the inliers are presumably thin enough to be worked through. The positions of quarries and mines are shown by circular black symbols proportional in size to annual output; and letter symbols indicating the principal uses are added. The text gives general information on the types of limestones, their age and distribution, and also production figures since 1922. It is written with the needs of the non-geologist in mind. Both map and text are of interest from the economic rather than the geological point of view.

A. M. FERRAR

EUROPE AND ITS BORDERLANDS. By ALAN G. OGILVIE. *Edinburgh/London: Nelson*, 1957. 9½×7 *inches;* xii+340 *pages; maps and diagrams. 42s*

A single volume on the geography of Europe must be condensed and selective; moreover this can be treated in several different ways and written for different classes of reader. What balance should be struck between aspects and regions? How much attention should be paid to the historical background to the present geography? How up-to-date should such a work try to be about changing political, economic and demographic conditions? Indeed, since the concept "Europe" is now so variously interpreted (and narrowed) by statisticians and even by geographers, what territorial extent should be attributed to the smallest of continents?

We have certainly travelled far since Lyde's whimsical 'The Continent of Europe' (Macmillan, 1913) first appeared. A few useful texts are now available to students, notably Shackleton's 'Europe' (Longmans) and Hoffman's collaborative 'A geography of Europe' (Methuen), but these are quite different in plan and content, and there is room for another, freshly conceived, such as 'Europe and its borderlands.' This last work of Professor Ogilvie, which Dr. C. J. Robertson completed by adding four short sections and saw through the press, has been awaited with some interest. Here we are offered the mature product of Professor Ogilvie's long work of teaching at the University of Edinburgh in a field of his special interest. 'Europe and its borderlands,' like the other geographies of Europe, will doubtless incur criticism and earn measured approval. Those who expected an historical geography of Europe will be disappointed, although many basic historical aspects of the geography of Europe are adequately and interestingly discussed. Those who expected a full-dress regional treatment will be dissatisfied, for the quarter of the book devoted to major divisions,

such as "The west Mediterranean lands," "Central Europe," "The eastern bridgelands," and "France," makes no pretence to regional analysis. Instead, the book is essentially a systematic discussion in turn of the many aspects of Europe's geography—*e.g.* land and sea, climate, the human imprint, population, agriculture and rural settlement. In such sections as the last, regional differences are distinguished and summarized. Professor Ogilvie conceives the continent within its conventional limits but wisely includes its Mediterranean and Middle Eastern borderlands. His book provides essential background to advanced regional study of the chosen area as well as a lucid and balanced introduction for the general reader. Although 'Europe and its borderlands' carries no book lists and little annotation, it clearly results from wide reading and much reflection. This reviewer notes points of novelty rather than points for criticism. Professor Ogilvie conceives geography broadly as rooted in the social history of specific and limiting physical environments. While he indicates gaps in knowledge, he generalizes vigorously. His writing, too, is terse and finished, and his publishers have turned his work into a handsome volume which is a pleasure to hold and behold.

W. G. EAST

CYPRUS. A portrait and an appreciation. By Sir HARRY LUKE. *London: Harrap*, 1957. 8¾×5¾ *inches;* 190 *pages; maps, illustrations and glossary.* 21*s*

In this short text Sir Harry Luke has painted a vivid portrait, illuminating his subject with a subtle blend of history and landscape, literature and legend, personalities and religions. Well-chosen illustrations, a useful glossary, and three maps add clarity, and it is no great disadvantage that the author's preference for the older systems of transliteration conflicts with official use in some place-names. Since he first saw it in 1908, Cyprus has manifestly continued to deepen its hold on the author's affections, and this appreciation is enriched by his breadth of experience and intimate knowledge, not only of Cyprus, but of its wider setting in the Middle East.

The desire to correct the distorted view presented by current events is the author's main justification, but he modestly adds a minor one in reclaiming unacknowledged fruits of his own researches, and to this we owe the delicate touches of historical, literary and linguistic detail which animate the portrait. Wisely, the reader is left to consult appropriate sources for material on recent economic developments, and geographers will not find their specific interests pictured here. But geographical influences are discernible nevertheless, and the book will amply reward those who, guided by the author's insight, penetrate to the heart of the island's character.

Sixteen chapters follow the introduction, seven leading chronologically from the dawn of history to the present day. One dwells all too briefly on mountain landscapes, balanced by two on Nicosia and Famagusta in the lowland. Another five present some of the human elements. Everywhere, historical reflections colour the landscape and outlook of the people today, and the significance of three centuries of Ottoman rule, often lost among the glories of Antiquity or the drama of the Middle Ages, emerges clearly.

An impartial commentary on Enosis completes the picture, enhancing the faithfulness of the portrait in demonstrating the alien appearance of these political elements, which spring from nationalism in relation to the Eastern Churches, and from an understandable reluctance for self-government. In this setting self-determination means nothing, partition is unthinkable, and though published too late for analysis here, Lord Radcliffe's Constitutional Proposals can be usefully evaluated. Those who know Cyprus will be grateful for this revealing portrait; those who do not will be tempted to learn more of the fascinating personality which inspired it.

M. MARSHALL

CYPRUS LAND USE MAP: 1 : 253,440. By R. R. RAWSON and K. R. SEALEY. *London: Geographical Publications*, 1956. 20½×32½ *inches*

This land use map covering the island of Cyprus on a scale of 1 : 250,000 calls for

consideration on two counts. First, it serves as a pilot sheet for the World Land Use Survey, for although the map does not represent the final stage envisaged by the Survey, it follows the suggested plan to an intermediate stage; and secondly, it is a contribution of data and technique to Mediterranean land use study. The intention of the World Land Use Survey is to publish a series of maps on 1 : 1,000,000 scale, together with explanatory memoirs, so as to provide "a factual land use map with a comparable fundamental framework but allowing subdivisions within this broad structure to meet particular needs." The flexible structure of the plan leaves the ways and means and the scale of plotting of the basic survey to be determined on the merits of individual cases and it is envisaged that individual countries may publish these plots although the interest of the Survey itself will rest solely on the 1 : 1,000,000 map and its accompanying memoirs.

The present map is a basic plot from which the survey could proceed to its multi-coloured 1 : 1,000,000 publication. Presumably the cost of this type of printing does not justify following the process right through at the present time. Since this is not a definitive publication, the main interest will lie in the success of the classification in practice. The team who prepared this map have found it necessary to introduce a subdivision between irrigated and non-irrigated land. In all other respects the system has stood the strain of trial and an easily-read map has resulted.

Coming to the map's more general significance as a Mediterranean study, the use that has been made of aerial photography is of considerable interest. On the ground, lack of cadastral plans, coupled with great complexity of detail, often makes accurate work extremely difficult. Although it would be wrong to assume that a similar quality of aerial coverage will be generally available, its use is clearly a great advantage whenever possible. The use of aerial photographs is now sufficiently well established for questions of accuracy in interpretation by competent workers to be generally discounted. The influence of laws of land tenure and associated problems of fragmentation is, however, particularly important in areas of peasant cultivation, and this information can only be collected on the ground. As it stands, this map remains incomplete, requiring the backing which only an accompanying memoir could give. If the result of use of aerial photography were to allow the mapping to outstrip the memoir it would be unfortunate. The map as it stands has established the generally satisfactory basis of the survey, but has underlined the importance of text to go with it.

R. D. HAYES

FINLAND AND ITS GEOGRAPHY. Edited by RAYE R. PLATT. *London: Methuen*, 1957. 7×10½ *inches; 510 pages; maps and plates.* 60*s*

There is a mystery about this volume. On page 6 is the statement "First published 1957," yet with the exception of the title page it appears to be identical with a volume published in 1955 by Duell, Sloan and Pearce Inc. (New York). Both issues are described as being "An American Geographical Society Handbook," and it is difficult to see an excuse for such a misleading statement about date of issue. This volume provides an account of the geography of Finland which is basically similar in content to that adopted for the Admiralty geographical handbooks of the Second World War. As no volume was prepared on Finland in this series the American version helps to fill a void. Some American geographers have, for a number of years now, been arguing that the logical order of a geographical analysis should be broken and that a study should consist of a statement of a problem and its explanation and not of a systematic statement of the features commencing with the physical. In this handbook the first two chapters are concerned with history and government, the next two with population, social structure and diseases, the next eight with agriculture, industries, transport and commerce, chapter 13 with cartography, chapter 14 with climate, chapter 15 with natural vegetation, and the last with geographical regions. There are two appendices—the first dealing with "geology and surface configuration," and the second with official nomenclature. The contents are mentioned at length

because it was found in reading this volume that the order of treatment was a great irritation. Repeatedly there is reference to later sections, which may be satisfactory in a pure reference work, but should not be necessary in a volume which is surely meant to be studied as a whole. Chapter 5 on agriculture is an example, with references to chapter 14, "Climate." As a point of detail it may also be queried why the section on "Cartography" is elevated to a chapter while "Geology and surface configuration" are relegated to an appendix.

There is no suggestion that the work of compilation has been skimped and there is in this volume a valuable accumulation of basic material. Together with 'Suomi, a general handbook of the geography of Finland' (published by the Geographical Society of Finland in 1951) English readers have a valuable background to Finnish geography and the problems of the modern state. The photographs and diagrams of this volume are an excellent feature although some of the latter, *e.g.* Figure 42, are rather difficult to read.

A. C. O'DELL

CARTE MORPHOLOGIQUE DU BASSIN DE PARIS. By A. CHOLLEY and others. Mémoires et documents, V. *Paris: Centre nationale de la recherche scientifique*, 1956. 16½×8 *inches; 114 pages; map in four sheets in separate folder*

This memoir presents a coloured map of the Paris Basin in four sheets on a scale of 1 : 400,000, together with a commentary of 100 pages by those responsible for mapping the different regions of the area. The map, printed in seven colours and black, distinguishes erosion surfaces, exhumed relief, faults and folds, various Quaternary deposits and supposed relief forms, types of slopes, and several aspects of the drainage. The result is, of course, quite complicated and liberal use of the key must be made until one is familiar with the types of shading.

The general attitude towards geomorphology reflects French preoccupation with exhumed erosion surfaces—and hence with Mesozoic and Tertiary stratigraphy—and with periglacial erosion. Thus, we have post-Hercynian, sub-Cretaceous, Eocene, Oligocene, Miocene and Pliocene surfaces and compound surfaces ranging over two of the Tertiary periods. These various surfaces are usually slightly deformed and yet not so deformed as to be unrecognizable, so that their separation and identification in those areas where deposits on them are scanty must have presented difficult problems. On the map the surfaces are shown as continuous apart from the larger valleys and, although this is inevitable even on the generous scale chosen, it tends to give a false impression of the importance of these features in the landscape; for, even allowing for the great extent of plateau in the Paris Basin, the surfaces are probably not as continuous as shown.

The emphasis on different features varies regionally with the geographer concerned. The nearest approach to English geomorphology is probably provided by Dr. Pinchemel, who has worked on both sides of the Channel and who writes of the exhumation of the Pliocene surface in the north-east of the basin by a series of eustatic terraces ranging from 240 to 80 metres above sea level. The most extreme approach is probably that of Professor Tricart, who attributes an enormous importance to periglacial erosion and who regards the chalk plain of Champagne as the best example in France of periglacial peneplanation, a suggestion which seems to apply to no other comparable area of the Paris Basin and, for that matter, to no area of southern England, where periglacial action ought to have been more violent. The same author confidently dates various phases of erosion to specified interglacial and glacial periods, but, in view of the scarcity of interglacial pollen diagrams in France, one wonders how trustworthy these dates are.

None the less, the map is a notable achievement and, with the text, gives an excellent summary of French geomorphological views at the present time. They form an extremely interesting contrast with the views generally expressed on the denudation of southern England.

B. W. SPARKS

GÓRNY ŚLĄSK: Prace i Materiały Geograficzne. *Kraków: Polish Geographical Society, Katowice Branch*, 1956. 680 *pages*. 48 *zloty*

Upper Silesia has been the subject of numerous German monographs and of not a few in Polish. Most of these have been concerned only with the mineral resources of the area and with the development there of what has come in some quarters to be called the "Eastern Ruhr." This volume differs from those that have preceded it not only in its much greater length and exhaustive bibliography, but also in the better balance which it maintains.

The book is made up of thirteen separate contributions by members of the Katowice branch of the Polish Geographical Society, and is introduced by Professor Antoni Wrzosek of the University of Kraków. The papers range from studies of the geology (S. Siedlecki) and morphology (J. Szaflarski), to the prehistory of the region (J. Orłowski) and the growth of population (T. Ładogórski, P. Rybicki, M. Bytnar-Suboczowa). The core of the work and by far the longest contribution is J. Kokot's "Economic rebuilding of Silesia," a most valuable survey of recent and current trends in the development of the Upper Silesian industrial region. The volume is completed with studies of the administrative boundaries in the area (F. Maroń and W. Kaczorowski), the changes in the land forms—subsidence, spoil-heaps and the like—which result from man's activities (A. Hornig), workers' settlements (I. Nalepa-Orłowska) and tourism (B. Gajdzik), and ends with an essay in bibliography (L. Mazurkiewicz-Herzowa).

A book planned and written in this way lacks the unity which would have been given it by a single author. It is easy to find places where the thirteen contributions overlap, and also to point to significant omissions. The book contains very little on the historical background of the heavy industries, and one looks in vain for an adequate account of the lead and zinc industries. But this volume is only the beginning. It is understood that a second is in preparation, and if it maintains the high standard set by the first and also fills some of the gaps which the latter has left, the work as a whole will make a most valuable contribution to our understanding of one of the more important of Europe's industrial regions.

The authors of this book are members of a Polish provincial geographical society. The book is not the product of a university department; it is the work of a group of amateurs who devote what time they can to their research. The result is a high tribute not only to their energy and ability, but also to the high level of geographical studies in Poland.

N. J. G. POUNDS

VILLAGE IN THE VAUCLUSE. By LAURENCE WYLIE. *Cambridge, Mass.: Harvard University Press*, 1957. 8×5½ *inches; 345 pages; plates.* 45*s*

Half the French nation still live in rural communes, and an even larger proportion have been born and brought up in the countryside. A full appreciation of French civilization must obviously involve a knowledge of the pattern of life in the village community, and this book gives an invaluable portrayal of a particular example, which has been very carefully selected to avoid abnormal circumstances. Although both the village and its inhabitants appear under pseudonyms, the study is actual and specific, based upon information collected by the author, an American sociologist, during a year's residence (1950–1) with his family in a typical perched village east of Avignon in the basin of Apt between the prealpine ranges of the Vaucluse and Lubéron.

Two admirable introductory chapters provide the setting of the village in place and time, and contain an illuminating description of its economy and demography as they have changed during the last century and a half. There follows a detailed account of life in this social environment from infancy, through schooldays and adolescence to marriage and household responsibilities. The folk habits, the problems, pleasures and attitudes of the inhabitants are analysed with remarkable insight and telling use of anecdote, and withal a vivid impression of a community of real persons is conveyed

in this most readable and fascinating book. It should be read by every traveller to the south of France, and by all who wish to understand the French people better.

A. E. SMAILES

GERMAN ATLASES

'Klima Atlas für das Gebiet der Deutschen Demokratischen Republik' (Berlin, Akademie Verlag, 1953, £7) is a painstaking and detailed portrayal of the factors which go to make the climate of East Germany. An introductory section contains maps of relief, soils and vegetation and of physical and climatic regions. The main body of the atlas consists of forty-eight maps, each on a scale of 1 : 1,000,000 of the usual climatic elements: temperature, precipitation, wind-direction, frost-free days, cloud, fog, etc. An interesting group shows the average beginning, end and duration of average day temperatures of 5° C. and 10° C. It is thus possible to see at a glance that Magdeburg has over 160 days each year with a temperature over 10° C. (50° F.), beginning about April 25, in contrast to the highest land on the Czech border which has under 130 days at this temperature, beginning about May 20. The work is completed by a group of five phenological maps and another of six examples of exceptional conditions and seven pages of diagrams. There is also a short explanatory text.

Volume I of the 'Agraratlas über das Gebiet der Deutschen Demokratischen Republik' (Gotha, VEB Hermann Haack, 1956, £15) is concerned with soils, their origin, classification and use. It consists of a succession of maps in 10 sheets, scale 1 : 200,000 in a loose-leaf binder. A pocket inside the back cover contains reductions on to one sheet (1 : 750,000) of each of them. Unfortunately the titles and legends of the maps are not readily translatable except by those with considerable knowledge of German technical expressions.

The 'Atlas von Berlin' (Hannover, Akademie für Raumforschung und Landesplanung 1957) of which twenty sheets have now been published, is the latest of the Deutscher Planungsatlas series. It takes the familiar form of the type of work we are accustomed to refer to as "National Atlases" and which in the face of the German tendency to fragmentation of the areas covered we must now surely call "Regional Atlases." The sheets, which are unbound and unnumbered, deal with a wide range of topics from the physical basis to the economic and cultural features of the metropolitan area.

All these atlases are well drawn and the colour printing is excellent.

A. M. FERRAR

ASIA

SOUTHEAST ASIA. By E. H. G. DOBBY. 5th edition. *London: University of London Press*, 1956. 8½×5 *inches; 415 pages; maps, illustrations and diagrams.* 18*s*

That a fifth edition of Professor Dobby's book has been called for within six years of the publication of the first edition is a welcome sign of the interest that is being taken in a region of great academic and practical importance to geographers and others; it is also a tribute to the stimulus that Professor Dobby himself has given to geographical teaching and research in Malaya and elsewhere.

But a lengthy review of the new edition is not called for; it is essentially the same in method, content and style as the first edition, which was reviewed in the *Journal*, 117 (1951), pp. 95–7. The maps are, in fact, exactly the same, so that, for example, the population map of Malaya shows the situation in 1945 although there was a census in 1947. The text has been revised in three main ways: by making a few concessions to critics ("peneplanation" has thus fortunately replaced "peneplainization"), by bringing statistics as up to date as possible and adding new pieces of factual information (for example, on cocoa growing in Malaya); and by adding paragraphs on recent developments at the end of certain chapters. The last-named category of revision

is, of course, the most important, and in attempting it Professor Dobby has been handicapped because the length of each addition has been conditioned by the space which could be made available without disturbing the pagination. Inevitably all additional paragraphs are too scanty, and some topics have fortuitously achieved more prominence, through falling where space was relatively plentiful, than have other topics of greater significance. Thus the additional paragraph on Singapore can run to a list of new factories, while the discussion of post-independence developments in Burma and Indonesia is so brief as to be misleading.

In the reviewer's opinion, a much more drastic revision is needed, not only because of the rapid and bewildering change to which South-east Asia is now being subjected, or because so much is now being written on the region (some of it is included in the bibliography); but also, and more cogently, because of the hints on a more humane and a more profound methodology that have been given by the publication of such works as Robequain's 'Le monde malais' (translated into English by E. D. Laborde as 'Malaya, Indonesia and the Philippines') and Gourou's 'L'Asie.' Surely it is now time for the author and the publishers to take their courage in both hands and to make a thorough revision, a revision of method as well as of fact. The interests of geography and the academic standing of the book would be well served if this were done.

B. H. FARMER

THE TIMOR PROBLEM. By F. J. ORMELING. *Groningen and Djakarta: J. B. Wolters*, 1957. $9\frac{1}{2} \times 6\frac{1}{4}$ *inches;* vii+284 *pages; maps, photographs and tables*

This book by a former head of the Geographical Institute at Djakarta is sub-titled "a geographical interpretation of an under-developed island" though in fact it deals only with the Indonesian (formerly Dutch) half of Timor. The problem to which it refers is essentially the local variation of the problem which characterizes so many of the world's under-developed lands: population growth resulting from the introduction of law and order and improved health services has disturbed the traditional balance between man and land, and this in turn is reflected in accelerated soil erosion and a steady undermining of an already precarious standard of nutrition and material welfare. However, while in many respects this economic problem is common to much of Monsoon Asia, Timor is geographically by no means typical of Indonesia as a whole. In particular, its south-easterly situation gives rise to a long and very pronounced dry season, in marked contrast to the high humidity which prevails over most of the rest of the archipelago, and its position in the older outer arc of the Tertiary Sunda Mountain System means that it lacks the recent volcanic materials which have so spectacularly enriched the soils of Java, Bali and other nearby islands. Nevertheless a considerable portion of Timor is far from being intrinsically infertile, and prior to the Dutch pacification the local population—both Melanesoid and especially the more recent Indonesian–Malay immigrants—maintained reasonable standards of living by means of shifting cultivation. Meanwhile the island's forest products, notably sandalwood, dye-woods and wax, attracted a wide range of traders from various parts of Asia and Europe. For all practical purposes Dutch rule did not extend over the interior of Timor until the beginning of the present century but thereafter its effects in counteracting the main Malthusian checks were swiftly felt. Unfortunately, however, improvements in this respect were not accompanied by any significant developments in agriculture, other than an increase in the production of dietetically inferior cassava, and the introduction of cattle which led to new conflicts between cultivators and herdsmen and to serious soil erosion, especially in the uplands.

After examining these various facets of the problem the book ends with a brief consideration of the measures which might be taken to restore the balance in the Timorese economy and to raise the peoples' standard of living. Here the geographer's contribution in helping to strike a balance between the conflicting recommendations of forestry, agricultural and veterinary experts is particularly valuable. The author

maintains a healthy caution regarding the popular panaceas of mechanization and mixed farming and stresses the need both for more research into the detailed problems of the environment and for raising the educational level of the population before embarking on any sweeping changes in agricultural technqiues. The possibilities of small-scale industrialization and the obvious need for better transportation are also considered but it seems clear that without more effective direction from above the situation is likely to get worse rather than better in the foreseeable future. This is a most useful case study which merits the attention of all scholars and administrators who are concerned with the problems of under-developed tropical lands.

CHARLES FISHER

DIE INSEL BORNEO IN FORSCHUNG UND SCHRIFTTUM. By KARL M. HELBIG. *Sonderdruck aus dem Mitteilungen der geographischen Gesellschaft in Hamburg.* Band 52, 1955. 9×6¼ *inches;* 290 *pages; maps and illustrations.* Copies available from the author, Hamburg-Altona, Bleickenallee 22, Price U.S. $6

It is the purpose of this study to show that, notwithstanding the sparseness of its population and the backwardness of its economic development, Borneo is by no means the unknown and unexplored island which it is all too often depicted as being. In support of this contention the author lists 2410 sources of various kinds—maps, books, periodicals, articles, etc.—which, exhaustively catalogued according to subject matter, account for some two-thirds of the 290 pages of his book. This impressive bibliography is preceded by a detailed survey of the discovery and exploration of the island (both by Europeans and non-Europeans), culminating in the numerous geological, anthropological and other scientific expeditions of the past hundred years or so. The folding map which illustrates the main journeys referred to in the text is by no means easy to follow, but the sketch maps showing the extent of topographical surveys are adequate for their purpose. Finally the book contains some excellent photographs of Bornean places and peoples taken by the author himself in the course of his 1937 expedition. Altogether this is a most useful work of reference which fully vindicates the author's opening contention.

CHARLES FISHER

PIONEER PEASANT COLONIZATION IN CEYLON. A study in Asian agrarian problems. By B. H. FARMER. *Oxford University Press,* 1957. 9×5⅞ *inches;* 387 *pages; maps, plates, tables.* 55*s*

This book is a remarkable achievement. It is an authoritative text on the problems of the government sponsored colonization of the Dry Zone in Ceylon, a balanced and stimulating commentary on agrarian development in tropical lands, and a notable example of the value of the geographer's methods and approach in a field which is far too often regarded as the preserve of the economist, administrator and rural planner. It is both an academic study and an outstanding exercise in applied geography.

Mr. Farmer deals with all the major aspects of a notoriously many-sided subject and it is a tribute to his width of outlook and grasp of detail that the sections on historical development, the complexities of the tenurial system and the social life are as scholarly and convincing as those which are more commonly the business of the professional geographer. The material is extremely well arranged; Mr. Farmer leads the reader with deceptive simplicity through a maze of facts and controversial problems.

Studies by Western scholars of different aspects of "non-Western" societies are often criticized—sometimes with justice—for their bias and lack of insight. This is particularly true of former colonial territories, where even the most harmless statements are sometimes misinterpreted and used to political ends. Mr. Farmer's book might well serve as a model for future studies and as an essay in fairmindedness. For example: on the one hand, he makes the point that agricultural practices which appear inefficient or undesirable to Western eyes are in fact often well adapted to

local conditions and based on a rational assessment of factors not always obvious to an outside investigator (see pp. 46–8 and p. 284 *et seq.*). On the other hand, he shows how certain features of tenure and the accompanying vagueness of land title adversely influence economic development (see Part II, Chapter I).

This study is not addressed exclusively to the geographer and it should help in no small measure to enhance the standing of our subject. At the same time, Mr. Farmer has shown us that the ecological approach is a most fruitful method of study. His work has demonstrated this far more conclusively than the arid and often profitless discussions of the scope of geography. In his preface Mr. Farmer asks "the indulgence of my fellow-geographers, some of whom may consider that I have well overstepped the bounds of our study"; after reading this book it is difficult to believe that anyone could level such a charge and one can only hope that other geographers will follow Mr. Farmer across the boundary.

W. M. WILLIAMS

CAPTURED IN TIBET. By ROBERT FORD. *London: Harrap*, 1957. 7½×5¾ *inches; 256 pages; maps and photographs.* 18*s*

This is a book of exceptional interest on several counts. In the first place it gives one of the best pictures yet available of life in pre-Communist Tibet and this is followed by a fascinating account of the Chinese invasion which put an end to the independent existence of that state. But to most readers the greatest interest will certainly lie in the long and detailed account of the "brain-washing" techniques used by the Chinese Communists in order to compel their victims first to "confess" to non-existent crimes and thereafter to remodel their whole attitude to life in general and to the Communist régime in particular. Mr. Ford tells his story plainly but well. Having served in the R.A.F. during the Second World War he was appointed radio officer with the British Mission in Lhasa in 1945. Later, after a spell of service in Sikkim, he resigned from the R.A.F. in order to accept an appointment in Tibetan government service as the first radio officer in that country. His devotion to duty and his affection for the country he served led him to remain at his post until the Chinese invaders had cut off his only possible way of escape. Thus late in 1950 he was captured by the Communists and taken, via Sikang, to Chungking. Eventually, after making a false confession of little or no possible significance to his captors or to anyone else, he was suddenly sentenced in December 1954 to ten years' imprisonment and, even more unexpectedly, released some six months later. Mr. Ford does not attempt to conceal that his confession was made solely because he calculated that such action afforded the only possible means of obtaining his release. It was not, he insists, the result of his having been subjected to extreme physical hardships or of having been persuaded by "thought control" that he had in fact committed the crimes to which he confessed, and he states plainly that the fact that he had subordinated ideals to expediency is still on his conscience today. Nevertheless few, if any, who read his sober and courageous account of the years he spent in Chinese prisons will consider that he has serious cause for self-reproach and to this reviewer, who knows something of the lesser horrors of Japanese prison camps, his story rings profoundly true and affords some grounds for hoping that the effects of "thought reform" may not always be as deep or as lasting as is often assumed.

CHARLES FISHER

ASIAN TRAVEL

One of the paradoxes of modern times is that despite wider knowledge and faster means of transport more countries are inaccessible to the ordinary traveller than was the case thirty years ago. The mystery of the East has increased for this reason and books on Tibet or China are always read with interest, especially when they bring news, however scanty, of present conditions. Mr. Wignall tells in PRISONER IN RED TIBET (*Hutchinson*, 1957, 18*s*) how he visited Tibet involuntarily, and certainly he did not get very far, but he has been able to give an amusing and informative account of

his experiences and of life under Chinese Communist control. His report is all the more useful, since he had no preconceived ideas and, despite his discomforts, he retained his sense of humour. He gives illuminating descriptions of individual Chinese soldiers and officials and their attitude to political problems. The difficulty of finding any common ground with senior officials and their incredible ignorance of the outside world shows how great is the problem of coming to an understanding with the greatest power in the East. Further he shows how the Tibetans have reacted to the occupation of their country by a people who are not only alike to them in race, but also in outlook and philosophy. Many of his observations have been proved valid by recent events.

Mr. Mele's TIBET (*Allen and Unwin*, 1957, 30*s*) is quite another matter, since it shows in pictures the old Tibet, and covers the people and places between the Tsangpo and Sikkim and Bhutan. The photography is excellent, but without a fuller text the book cannot add greatly to our knowledge of current affairs. It is in effect a luxury which might find its place in libraries and can provide pictorial background to geographical or ethnological study of the country as it used to be.

It is always useful to be reminded of the past, and Herr Karlbeck's memoirs of his travels in China, as a collector of antiques, make an interesting series of stories, which show life in China before 1939 (TREASURE SEEKER IN CHINA, *Cresset Press*, 1937, 21*s*). His wanderings took him to Inner Mongolia, the edge of the Gobi desert and the mountains of Shensi. There is little about the great cities and much about the smaller towns and countryside. His descriptions include accounts of famine in Suiyan as well as the beauties of Huashan. Not least enlightening are his remarks upon the faking of antiques and the skill with which this is done. In some cases the work was so successful that fakes seen in dealers' shops in China appeared later in museums and exhibitions in other parts of the world. Altogether this is a book of value not only for those who enjoy the travels of others, but also for readers who wish to obtain an idea of what conditions were like in these now distant days.

Quite a different story is given in CHINDWIN TO CRICCIETH (*Caernavon, Gwenlyn Evans*, 1956, 12*s* 6*d*), by Charles Drage, which covers not only a wider range in geography but also a longer period in time. This is the life of Colonel Godfrey Drage, who started in the British Army, transferred to the Indian Army and served as a political officer in the Shan States of Burma. After retirement to his home in Wales he rejoined the Army to fight in France, Gallipoli and Palestine. He was a man of individuality and character; he brought originality to whatever he did and was a successful political officer and battalion commander for this reason. He had no illusions regarding his superiors and his remarks about stupidity in high places make enlightening reading.

J. E. F. GUERITZ

DER CHOGO-LUNGMA-GLETSCHER IM KARAKORUM. By W. KICK. *Zeitschrift für Gletscherkunde und Glazialgeologie*. Band 3, Heft 3, 1956, pp. 334–47

In a closely reasoned article the author reaches the conclusion that the effect of the trends of climatic variation during the last 150 years has been the same for Chogo Lungma ("the Great Valley") as it has been for the European glaciers, although he believes that this Asian glacier, unlike those in the Alps, did not reach its maximum until late in the nineteenth century.

He bases his view on the many published works on the Karakoram, on local reports and naturally on the evidence provided by the terrain. At the time of his investigations the Chogo Lungma glacier, "like the majority of the Karakoram glaciers" gave a clearly defined picture of a glacier in very marked retreat; the present length is given as 43½ kilometres, as opposed to previously stated lengths of 50 and 55 kilometres.

The surface has fallen 30–50 metres since the maximum. The tongue reaches almost to Arandu, a small village which lies at 2765 metres, an altitude which the author corrects to this figure from those previously accepted of 2875 and 2925 metres.

An interesting point brought out by these investigations is the probability that, in spite of today's decrease of glacierization, the ice cover is still greater than in much earlier days. He is able to show that in the early part of the nineteenth century the passes to the north of the Chogo Lungma, including the Muztagh pass to the Baltoro glacier and the Nushik pass to the Hispar glacier area, were open to commerce, bringing caravans and their attendant predatory robber bands. Today the Rakaposhi and the Bal-Chish ranges form a complete block to the north. He admits that the then increasing ice cover cannot be definitely stated to be the cause of the desertion of these passes; indeed, some authorities state that it is due rather to the robber bands, or possibly to the present trend—"the result of greater culture"!—to find easier and more comfortable routes. The author, however, doubts this.

The article is illustrated by a plan of the Chogo Lungma and its tributaries, which is adequate, although one could have wished to see a map stretching further afield in this little-mapped region. The eleven photographs give an excellent picture of the glacier itself and of some of its feeding glaciers. As the author himself says, much remains to be done in surveying this important glacial region, but the work is certainly a valuable summing up of past and present knowledge.

There is an English summary, unfortunately very brief. G. SELIGMAN

AFRICA

WEST AFRICA. A study of the environment and of man's use of it. By R. J. HARRISON CHURCH. *London: Longmans, Green*, 1957. $8\frac{1}{2} \times 5\frac{1}{2}$ *inches;* xxvii+547 *pages; maps, diagrams and plates.* 45*s*

This book was ". . . based on seven years of wide reading . . . and on very extensive field work. . . ." It is essentially an *extensive* work, a general survey of the geography of West Africa. On the grounds that it is the first advanced work on this subject to be written in English it is to be warmly welcomed. It brings together, particularly for French, Spanish and Portuguese West Africa, material which was available previously only from the specialized literature in these languages. But in its extensive nature lies its great weakness. In an attempt to be comprehensive it becomes all too frequently encyclopaedic. The text is presented often in little more than the form of notes. (However, to what extent is an author bound by his publisher who knows that it is this that will sell?) There is an absence of penetrating analysis, but even more unfortunate is the lack of attempts to achieve much integration of a great mass of material. There are some errors of detail in the facts themselves, but Dr. Church has wisely had each of his chapters read critically by experts who have worked intensively in the field in West Africa. Some interpretations are unacceptable; for instance, that Nigeria is "an epitome of West Africa." Indeed many of the chapter sub-titles are clumsy and not particularly meaningful.

Following on two sections which deal in general terms with the physical basis and resources of West Africa more than half of the book is devoted to the major territorial divisions in turn. The regional approach through which they are studied reveals itself to be the application to each division of a more or less rigid and well-known formula —introduction, historical outline, climate, geology and relief, etc. Inevitably there is repetition from the first two sections of the book. It is a conventional but not very satisfying approach, becoming tedious when pursued through seventeen chapters. Certainly it is a useful medium for the presentation of facts and in this respect Dr. Church has made a worthy contribution to the geographical literature of West Africa. From the preface it seems that the author envisaged more than a presentation of facts, yet his book does little to evoke much of the essential character of what we would agree to be "a delightful part of a fascinating and developing continent." However, with this work as an important basis we may look to the future for books on West Africa in English comparable with the works of Labouret and Richard-Molard.

R. M. PROTHERO

COASTAL BANTU OF THE CAMEROONS. Western Africa, Part XI, of the Ethnographic Survey of Africa. By EDWIN ARDENER. *London: International African Institute*, 1956. 9½×6½ *inches; 116 pages; maps.* 16*s*

THE SOCIAL ORGANISATION OF THE LOWIILI. Colonial Research Studies No. 19. By J. R. GOODY. *Her Majesty's Stationery Office, for the Colonial Office*, 1956. 9½×5½ *inches;* vi+119 *pages; maps, diagrams and plates.* 15*s*

The valuable series of publications to which each of these monographs belong are already well known and have received notice in previous numbers of the *Journal*. These appear to be worthy additions. Mr. Ardener writes of a section of the West African coastline which has long had European contacts. The ethnographic situation in the lands at the base of Mount Cameroon has been considerably affected in the present century by the influence of migrant labour attracted to the banana and oil palm plantations. By contrast Mr. Goody's study is of a small group in the remote north-west corner of Ghana, though they too have been influenced by neighbouring peoples. Both writers are social anthropologists and they write essentially in that vein. There is valuable information from each study for the geographer, relating to population, settlement patterns and agricultural practices among other things. But he will have to search for it. As always in studies of this kind the peoples appear to exist in an environment which can be briefly dismissed; by Mr. Goody, in two paragraphs which are, however, well written. Other matters are of greater significance to anthropologists; for example: "The interstitial position of the LoWiili, and their cultural eclecticism, are demonstrated by the confusing array of xylophones at their command, . . ." Obviously we differ in what we feel to be significant.

R. M. PROTHERO

DESCRIPTION DE L'AFRIQUE. By JEAN-LÉON L'AFRICAIN. New edition translated from the Italian by A. Épaulard, with notes by A. Épaulard, Th. Monod, H. Lhote and R. Mauny. *Paris: Adrien-Maisonneuve*, 1956. 2 *volumes.* 9×7½ *inches;* 630 *pages; maps and plates.* £9 9*s*

This new translation and edition of Leo Africanus' great work on Africa was very nearly lost owing to General Épaulard's untimely death in 1949. The manuscript was eventually found by his widow and at long last came into the hands of Monsieur Lhote who, with the equally eminent Saharan specialists Professor Monod and Monsieur Mauny, completed the notes which the editor had left unfinished, and together they have produced this admirable work. It was needed by scholars of history and geography alike. Since the last English edition of Leo Africanus' great work by the Hakluyt Society in 1896 in three volumes, so much work in and about North Africa has been done as to make Dr. Robert Brown's notes on John Pory's translation of 1600 quite out of date and almost useless for modern research. The French edition by Schafer of Temporal's translation of 1896–8 is also difficult to obtain and, of course, long since out of print. The editors of this new French translation and edition have adopted the rather novel but most successful method of initialling certain of the more important notes on subjects which one or other of the specialists has found occasion to add to Épaulard's comments. And of course none of such opinions could be more valuable than those of Monod, Mauny and Lhote, all of whom have vast Saharan experience in the field, and of original sources. Quite apart from their value a number of the notes are amusing, and interesting well beyond the sphere of Saharan studies. Moreover, the notes do not presuppose that the reader is a Saharan expert or an Arabist. The work is nicely printed in good legible type. The chapter sections and paragraphs are well set out with an admirable table of contents (nine pages of double columns) of the chapters and sections by subjects as well as thirty-eight pages of index (in double column). Unfortunately, the maps and illustrations are not of the same quality. The diagrammatic maps are clear but poor and unattractive. The coloured reproduction of Texeira's Portolano of 1573 (in the Bibliothéque Nationale)

as frontispiece to Vol. 1, and the monochrome of Mattia Hassio map of Leo's Africa of 1737, as frontispiece to Vol. 2, are not worthy of these two valuable volumes.

RENNELL

THE FOUNTAIN OF THE SUN. By DOUGLAS BUSK. *London: Parrish*, 1957. 9×6½ *inches; 240 pages; maps and plates.* 35*s*

This book, written by the former British Ambassador to Ethiopia, is disappointing as a book but rewarding for its first-class illustrations and the charm and humour of its writing. The text, however, has no unity of structure. The first 125 pages deal with long tours by car caravan in Ethiopia: the last three chapters are accounts of mountain climbing expeditions in the Ruwenzori and Kilimanjaro mountains; the only connection they have with the first part of the book or with each other is that they were accomplished while the author was on leave in East Africa from his post. If the first part of the book could have been expanded to make a volume it would have constituted an interesting modern account of life and travel in post-war Ethiopia. But even the first part suffers from being rather disseminated, which is no doubt partly due to the author's scrupulous care not to offend by political allusions or to jar on sensitive memories. Such excursions as there are into history, as for instance in connection with Salt's journeys of 1809–10, are admirable but too few and too scattered to leave the reader with any sense of the story and background of Ethiopia. So careful has Mr. Busk been, that there is scarcely a reference to the Italians and their magnificent road-building achievements, the remnants of which still provide at least the backbone of road communications in the country. The author could have said so much so well and so interestingly that he leaves a regrettable sense of disappointment which is mitigated only by the fine coloured photographs of this beautiful land.

RENNELL

THE BRITISH EAST AFRICAN TRANSPORT COMPLEX. By IRENE S. VAN DONGEN. *Chicago: The University of Chicago, Department of Geography*, 1954. 9×6 *inches;* x+172 *pages; maps and illustrations.* $3

For an East Africa which includes Kenya, Uganda and Tanganyika, Dr. van Dongen gives a useful, interesting and reasonably comprehensive account of the development of the means of transport and shows how, with some strains and stresses on the way, the different elements have grown into the complex which now serves the needs of the region. Inevitably, the main emphasis is on railways: road and air transport and port-handling receive attention, too, but little is said about the use of inland waterways.

The author is at home in the study of transportation, and it is for this reason that she succeeds in making a contribution to the economic geography of East Africa. When she extends her range to the geography of production, her touch is sometimes less sure, as for example in the treatment of plantation agriculture in Uganda; and there are certain shortcomings in the physical background of the study. The schematic map of average annual rainfall over East Africa (p. 40) shows an area with over 60 inches stretching uninterruptedly from Lake Victoria to the edge of the Western Rift valley; and the important point that the "Way to the West" crosses a considerable dry belt is thereby missed. Taking up a topographical point, it is difficult to understand the statement that the branch line from Gilgil to Thomson's Falls was laid "across Laikipia Plateau and Aberdare Range" (p. 35). And the line from Kahe Junction to Mombasa is 20 miles shorter than that from Kahe Junction to Tanga, and not, as stated on p. 120, longer by 80 miles.

The latest statistics used are those for 1952, and reports up to the year in which the book was published are quoted in the bibliography. Of the various changes which have occurred since 1954, the biggest is that associated with the completion of the railway extension to Kasese, enabling the copper mine at Kilembe and the copper smeltery at Jinja to come into production. All this happened towards the end of 1956.

S. J. K. BAKER

THE EAST AFRICAN RIFT SYSTEM. By F. DIXEY. *Colonial Geology and Mineral Resources Bulletin, Supplement No. 1. London: H.M.S.O.*, 1956. 9½×6 *inches; 71 pages; maps and illustrations.* 7*s* 6*d*

The East African Rifts, including the lower Zambesi and the Luangwa valleys, have exerted a compelling fascination not only on geologists but on most travellers by their striking scenery of sunk-lands close to high plateaus or mountains, their volcanoes and lava fields, their lakes and rivers, and their special fauna and flora which have rendered parts of these regions so admirably suitable for National Parks. The considerable and often controversial geological literature on these remarkable features has dealt mainly with the late Tertiary to Recent earth movements and the character of the associated faulting and vulcanicity. Dr. Dixey has for many years concerned himself with two other aspects of the Rifts: the close association of highlands and rift valleys, and the evidence of the ancient geological history of the Rifts themselves. These features are well displayed in Nyasaland where Dixey first commenced his studies, which have since been followed by work done in Northern Rhodesia and Kenya besides many visits to other parts of the extensive Rift System. The interesting relationships of successive erosion cycles to the Rifts have been discussed by him in a number of papers culminating in a recent survey entitled, "Some Aspects of the Geomorphology of Central and Southern Africa" (Alex. du Toit Memorial Lecture, 1955. *Trans. geol. Soc. S. Africa* LXVIII).

Since 1946, extensive air photography of the regions and the great increase in geological mapping by official surveys, together with the improved means of access have added greatly to our knowledge of these vast geological structures. This memoir brings together Dixey's own extensive observations and much recent work by geological surveys which is for the most part little known outside Africa. The evidence clearly confirms the geologically ancient origin of the Rift System, which had been demonstrated by Dixey in the distribution of Mesozoic sediments and volcanics and their associated unconformities in the Nyasa, Rukwa and Tanganyika Rifts. From the correlation of erosion surfaces with bevels on the highland masses it is shown that, as with the Tertiary movements, the Mesozoic movements were complex and involved uplift as well as depression; present highlands are in many cases residuals of a widespread and long continued uplift which has been of perhaps more fundamental importance than the down-faulting. The age of much of the Rift System is suggested by Dixey to date even from pre-Cambrian times. While there is much evidence to demonstrate the coincidence of pre-Cambrian structural lines and more recent faulting (which is well shown on the excellent air photographs reproduced), not all geologists working in Africa will however go as far as Dixey in supporting this thesis.

There follows a discussion on the extension of the Rift System northwards to the Red Sea–Jordan–Syria structures, and southwards to the Lebombo Monocline in Mozambique and Natal. Recent evidence from drilling records by oil companies on either side of the Mozambique Channel shows considerable analogies in structures and ages of movements with rift structures. Dixey suggests that the submergence of the East African coastline is to a large extent complementary to the rise along the Rift belts. Finally the tectonics of the Rift System are discussed in the wider context of the "basin-and-swell" structure of Africa first propounded by the German school and recently emphasized by Brock.

One important omission is the discussion of the vulcanicity associated with the Rift System at various geological periods. A comprehensive account of the chemical and physical characteristics of the different volcanic fields and comparison with such ancient rift and igneous activity as occurs in the Oslo region would provide an interesting complementary study to the present one. One of the most fundamental implications of Dixey's emphasis on the antiquity of the Rift System and particularly of the Mozambique Channel is that it points to the permanence of the major structures of the continent and discourages the belief in the hypothesis of continental drift.

This monograph summarizes a great deal of recent work scattered in many records

and integrates it into a most stimulating account of the Rift System and its continental significance. J. W. PALLISTER

LE TERRITOIRE DES OULED SIDI ALI BEN AOUN. By A. BESSIS, P. MARTHELOT, H. DE MONTÉTY, D. PAUPHILET. *Paris: Presses Universitaires de France*, 1956. 8¾×10¾ *inches;* 108 *pages; appendices, maps and photographs*

As the sub-title indicates, this monograph is a contribution to the study of human problems in the Tunisian Steppe. The tribal lands of the Ouled Sidi Ali Ben Aoun comprise a very small part (20,000 hectares) of this steppe, 60 kilometres north of Gafsa and 150 kilometres west of Sfax. This tribe of 800 families was chosen for sample study by the Cercle d'Études Sociologiques de l'Institut des Hautes Études de Tunis. It was one of the first tribal territories to benefit from state aid in the "paysanat" plan of 1938 so that official interest had already been taken. The survey team comprised a geographer, a jurist, an official from the ministry of agriculture and an ethnographer. A simple questionnaire was used, and maps of land utilization (without scale!) and parcellation of holdings were made. A clear outline is first given of the physical background, emphasizing the climatic, relief and hydrological controls. This is followed by a useful historical chapter dealing with the evidence of past irrigation systems, the period of Bedouin occupation and, during the last thirty years, the gradual settlement of the tribe. The second part of the monograph deals with the problems of the new changes in relation to the tribal structure, the administration, and settlement. The third section consists of three chapters on the peasant economy, the social problems and the transformation of the social life.

This region, now becoming an outpost of the Tunisian Sahel with its humanized landscape, has been created out of the steppe. Since sedentary occupation began, cericulture has been less successful than tree culture, which is rapidly becoming important, especially for olives. Land parcellation, a reflection of the unequal distribution of wealth and the growth of population, together with the landless labourer, are already problems in a land unsettled by cultivators thirty years ago. This monograph is of considerable value since it describes in detail, conditions and problems which concern the administration of the whole Tunisian steppe. J. M. HOUSTON

ASPECTS ET RÉALITÉS DE L'ALGÉRIE AGRICOLE. Edited by L'Institut Agricole d'Algérie. *Algiers: Association des Anciens Élèves de l'Institut Agricole d'Algérie*, [1957]. 6×9¼ *inches;* 148 *pages*

The progress and present difficulties of agricultural production in Algeria are clearly summarized in this short account. A questionnaire sent out to agronomists by the Institut Agricole de l'Algérie forms the basis of the text. It is a work of popular interest rather than a detailed or specialized survey, and is divided into two main sections. The first contains seven general articles on themes such as the French contribution to the development of Algeria, animal production, adaptation of important crops, soil conservation, agricultural credit and insurance, and agrarian reform. The second and larger section of the book consists of regional reports which range considerably in scale and topic, from the history of several early colonies to more technical articles on crop production, rural credit and reforms. Altogether, there are twenty-three short regional studies.

Statistics are generally for 1954, although there is no consistency in the production figures, some of which are unfortunately only for 1936. The survey is creditably objective, well illustrated with photographs and a few maps. It provides a useful introduction to anyone interested in Algerian agriculture. J. M. HOUSTON

MARY KINGSLEY. By CECIL HOWARD. *London: Hutchinson*, 1957. 8½×5½ *inches;* 231 *pages; frontispiece and endpaper map.* 21*s*

This is a very readable biography of that remarkable Victorian woman, Mary Kingsley. Nearly two-thirds of the book are devoted to her travels in West Africa, especially

in French Equatorial Africa in 1895. The author has managed to abridge Mary Kingsley's own rambling account of her travels, which she published after her return, and yet make use of her words to tell the story. Her own style was too vivid and original not to be used wherever possible. She left plenty of material to work from; her published work included three books and several articles written between her return from West Africa and her death in 1900. There are also many letters printed by Stephen Gwynn in his biography published in 1932 and the author also acknowledges the use of letters written to John Holt of Liverpool which were not apparently used by Stephen Gwynn. It is a pity the maps are not better, but here the author has had no help from Mary Kingsley herself, who was so dissatisfied with the maps prepared for her 'Travels in West Africa' that she left them out altogether. "I can go on feeling I am the only African explorer who has *not* published an iniquitously inaccurate map," she wrote to her publisher. Mary Kingsley was not only an explorer. She said herself that she went to Africa to study fish and fetish, and she returned with specimens of both which delighted the zoologists and the anthropologists. As a scientist she insisted that people dealing with West African problems should know what they were talking about, and that policy-making should be based on a study of the African and his needs. She was a champion of the trading interests and an exponent of commercial imperialism. It is fitting that this book should appear at a time when relations between Britain and West Africa are being radically altered. Much that was done in the last fifty years can be traced to her influence.

F. ARMYTAGE

AFRICAN TRAVEL

It is not enough, when writing a book about Africa nowadays, to relate a number of anecdotes and experiences and to rely for the rest upon the exotic touches in the background. Very little of Africa is still the unknown continent which it was in the nineteenth century, and what goes on inside it has lost some of the flavour of novelty. The authors of five books of "Africana" have appreciated this in varying degrees.

THE CRY OF THE FISH EAGLE by Peter Molloy (*Michael Joseph*, 1957, 21*s*) is generally quite charming. He might have been excused if he had written his book simply to pad out his photographs, which are among the best the reviewer has seen of the Southern Sudan, but even without the photographs this book has claims to be the best which has been written about the area. It is certainly the best since 'The gentle savage,' and possibly the best of them all. There is much more in 'The cry of the fish eagle' than a description of the enormous and little-known game population of the Southern Sudan. In describing his work and travels as a game warden Colonel Molloy paints a fascinating picture of the people and the country and the bird life where he worked, and one feels that he really knew his subject, and was in sympathy with it. A reference to Kadugli when the author must have meant Kaduli will not disturb many readers, and there are refreshingly few of such unfortunate things. The style is very easy to read.

ADVENTURE BEGINS IN KENYA (*Robert Hale*, 1957, 18*s*) is a pleasant, light-hearted book, written by John Pollard, who loves the mountains of Kenya as well as the bird life, especially the Lammergeyers for which he is searching. The author's description of life on the *shambas* in the White Highlands of Kenya is highly coloured and vivid, but he recaptures best of all for the reviewer the elusive fascination of the summit of Mount Kenya, and the celestial practical joke of Kilimanjaro seen from far away. In the course of his description of the various expeditions which he made in search of the Lammergeyer, Mr. Pollard makes no claim to be more than an amateur mountaineer, but his book betrays the keen and well-informed naturalist. He has not been so well served by his illustrations as Colonel Molloy.

The medical and anthropological details in BLACK MAGIC AND WHITE MEDICINE (*Chambers*, 1957, 16*s*) are barely sufficient to sustain the reader's interest. Dr. Michael Vane's study of industrial medicine in South and West Africa seems to stand out in

contrast to the chronicle of a rather ordinary trip through the Belgian Congo. Even pygmies are in themselves not copy any longer! One is left with the feeling that the author's study of the clash between magic and medicine, about which he knows so much, was worthy of more serious treatment. It is hard to believe, as the jacket suggests, that Dr. Vane (or anyone else for that matter) "got to know over 100,000 Africans." There are a few oddities like "plumb-coloured."

AFRICAN BUFFALO TRAILS (*Robert Hale*, 1957, 18*s*) by John F. Burger is, as its name suggests, a catalogue of hair-raising adventures with buffalo in which the writer comes off best and most of the other characters finish up, as often as not, in trees. Mr. Burger would probably agree that he was an old-timer, writing for old-timers, and many of his tales are exciting reading. The book will please all who are interested in big-game hunting; its style might irritate those who are interested in Africans, and for the ordinary reader there is too much about buffaloes.

DESERT WELCOME (*Hodder and Stoughton*, 1957, 17*s* 6*d*) by Charles Hartnoll is different from the other books: it is about Libya, and not about "Darkest Africa," and the jacket describes it as a "very unusual travel adventure." The tourist trade in Libya is, of course, in its infancy, but to the reviewer it seems to be very much in the same category as those which Miss Rose Macaulay calls "Turkey books." It is a story of a trip to Libya "on the cheap," by some enterprising and observant young people, and the tale is told by someone who has lived in Egypt but who was discovering Libya for the first time. This is hardly enough to make it unusual. A great deal of the book is concerned with the sometimes painful logistics of the trip, and the efforts of the members of the party to adapt themselves to their unfamiliar surroundings. Much of the narrative is interrupted by complaints about the food and how un-English everything is. The photographs are excellent, and the descriptions of the country are good, once the author's jargon has been got over. The literal translations of Arab conversation, and the phonetic rendering of the remarks of an American who joined the party for some of the journey are disturbing. It is a pity that Mr. Hartnoll did not attempt a straight book about a country which is so colourful and little known, without all the commentary on his companions and their petty irritations. One feels he could have done it: the raw material is certainly there. W. P. G. THOMSON

NORTH AND SOUTH AMERICA

AMERICAN CITIES IN THE GROWTH OF THE NATION. By CONSTANCE MCLAUGHLIN GREEN. *University of London: The Athlone Press*, 1957. 9½×6½ *inches; xii+258 pages; map, illustrations.* 85*s*

Through a study of sixteen cities, Mrs. Green gives a remarkable picture of American history. Having grown in population from 4 millions to 150 millions within five generations, the United States already had more people in towns than in the countryside by the early twentieth century. New York exploited its geographical advantages from its beginning, and Baltimore, having grown as a port in the late eighteenth century, eagerly improved on nature by making wharves and land suitable for industrial growth. Boston, with its traditions of thrift and integrity, became a strong manufacturing and banking centre. Not all the cities prospered, and an interesting contrast to the general success story is the story of Holyoke and Naugatuck, two New England manufacturing cities that have not grown into vast cities. But success was achieved after unimaginable difficulties in some places, notably Seattle—and even Chicago had a slow start, though it grew faster than any other city in the world. "Americans built their towns and cities where geographic conditions promised the first settlers and later promoters a profitable future" (p. 216), even if the full potential advantages were realized only when railway and motor transport stimulated the growth of a Chicago or a Detroit. The picture of life in famous American cities was not always rosy but Mrs. Green points out that "In the cities, as in the villages and on the farms, poverty

existed, stark want virtually never. Ambition and the opportunities of a vast unsettled hinterland gave Americans faith that they were the way and the light" (p. 38). Enterprise led them to sluice away the low hills of Seattle, to jack up the buildings of Chicago so that hotel guests did not know that they were being raised up, or to plan Washington under the guidance of a distinguished Frenchman on a most unpromising site.

Always aware of the geographical factors, the author also points out that Detroit owes much of its modern growth to the fact that Mr. Henry Ford lived there. Few authors are more practical and down-to-earth in their writing, but the artistry of the work commands admiration. Over and over again, one has the impression that a curtain is lifted, and the life of a town in the early nineteenth century or at some other time, clearly shown. Wit and humour lighten scholarly pages, and there are fascinating glimpses of home life and the manners of society. So much geographical writing on towns is riddled with terminology that one turns with relief to a work that is at once so informative and so easy to read. The learning is abundant but it is worn lightly. It may well be true, as the author says, that the future growth of American civilization will reflect the standards of the city: it may even prove, as the author does not say, that city ways will penetrate more fully into the countryside in America than in Britain. It is a privilege to commend this shrewd and fascinating book.

T. W. FREEMAN

THE TIMES ATLAS OF THE WORLD. Edited by JOHN BARTHOLOMEW, LL.D. Mid-century edition. Vol. V. The Americas. *London: The Times Publishing Co.*, 1957. 20 × 12½ *inches; frontispiece*, xii *pages; plates* 97–120; *index* 57 *pages*. £5 5*s*

This, the third volume (Plates 97–120) of the new edition of 'The Times Atlas' to be published, is more homogeneous than its predecessors since it deals with the Americas exclusively. Among British atlases it must be unique for the large scales employed for these continents. American cartographers, for atlases at least, do not favour the use of layer colouring to show relief, so that an atlas of America in this style and on these scales is unusual. The cartographic style of the atlas in general has been discussed in reviews of earlier volumes; the present volume maintains the same high standard.

Sixteen of the twenty-four plates are allotted to North America. The settled areas of Canada, as far west as Edmonton and Calgary, are given on the scale of 1/2·5M. (40 miles to 1 inch), with western and north-west Canada, and the remainder of the north and Arctic America on progressively smaller scales. Much survey work has been done in the north in recent years and this has been utilized; the lake-strewn areas of the Canadian shield show up strikingly, and some interesting drainage patterns emerge, e.g. in northern Manitoba and the Great Slave Lake area. The United States are covered in nine sheets at 1/2·5M with the exception of Alaska, while there is one plate, the "Middle Atlantic Sea Board," at 1/1M (16 miles to 1 inch approx.). Special emphasis is placed on the road system, shown in red, and Special, United States, and State Highways are distinguished. National Parks and National Monuments are also shown and named. This detail, especially in the populous north-east, makes the maps in places rather overcrowded with names. But these are well-known areas, and it would be difficult to suggest what place-names might be omitted. The map of Mexico on one plate at 1/5·5M also shows some overcrowding.

The sheet-lines work out conveniently for the States except for one sheet which is made up of four main insets—Alaska, the "Panhandle," and southern Texas in two portions. South America is given at 1/5M on five sheets; portions of Brazil appear on all five—an interesting reflection of the relative size of that country, though it results in there being a general map of Brazil on a very small scale only.

A considerable number of city plans are included as insets, mostly on the same scale, 1/250,000, for comparison. The relatively large scale of the maps ensures a plentiful supply of names for the index, making it, with approximately 45,000 entries, a very useful gazetteer for the United States, no less than for South America.

The volume concludes with a bathymetric map of the Pacific. With nine tints, from buff through green to dark blue, it brings out well the striking contrasts in the ocean floor particularly in the western basin, where the juxtaposition of the continental shelf and the great troughs is remarkable. It is not always easy, however, to pick out the island groups.

G. R. CRONE

WISSENSCHAFTLICHE ERGEBNISSE DER FINNISCHEN EXPEDITION NACH PATAGONIEN 1937–38 UND DER FINNISCH-ARGENTINISCHEN EXPEDITIONEN 1947–53. Band IV. The Pleistocene of Fuego-Patagonia, Part 1: The Ice and Interglacial Ages. By VÄINÖ AUER. *Helsinki*, 1956. $9\frac{3}{4} \times 7$ *inches; 226 pages; maps and plates*

This work is marred by a clumsy and obscure style of English, by careless usage of technical terms, and by unsubstantiated conclusions. Unorthodox views on geomorphological processes are held; for example, badlands (p. 105) and smooth plateaus (p. 118) are both ascribed to glacial action, and fiords in Tierra del Fuego are said to have been valleys with lakes during glacial ages (p. 190).

Briefly, the author's conclusions are as follows: the Tehuelche gravel was deposited by dead ice at the end of an "old glaciation," during which ice covered the whole of southern and central Patagonia. A long interglacial period was followed by two closely spaced glaciations during which ice covered Tierra del Fuego and the extreme south of Patagonia but elsewhere reached the Atlantic only on a narrow front in the north. East of the Andean ice many higher tablelands were local centres of glaciation. The ice retreated very early in the Late Glacial and by Allerød times the glaciers were very small.

A few major criticisms must suffice. The Tehuelche gravel, which Caldenius believed to be a soliflucted fluvial deposit, is said to be almost certainly of glacial origin; this belief is supported with obscure statements such as: "Obviously on the tablelands there was little movement of meltwaters on the glacier surface, so that dead ice was not merely stagnant but wholly without movement" (p. 177). At Viamonte, Tierra del Fuego, a till on Pliocene sandstone is separated from two till layers above by 10 centimetres of peat. The lowest till is unquestioningly correlated with the Tehuelche gravel, and the peat is "unhesitatingly" called interglacial and not interstadial on account of the time necessary for its formation. There follows the extraordinary statement that the peat ". . . is not *in situ*, but has been transported by ice from far to the west, and then deposited in its present location" (p. 17). In the Rahué valley in northern Patagonia, "the whole of the alternation of the Pleistocene so important to South America" is said to be visible (p. 24). Between two tills are beds of peat, diatomaceous earth and sand. It is concluded that the diatomaceous earth was formed in glacial lakes while peat, whose flora points to a wetter climate in the area than at present, formed round the edges. The sand is of glaciofluvial origin. It is then stated (p. 32) that these deposits "indicate that . . . there was a long interglacial time of favorable conditions."

The author believes that many local centres of glaciation existed on the tablelands at 1000 metres in the north and 400–500 metres in the south. In east-central Patagonia, for instance, their former existence is shown by "redeposits of Tehuelche, by the grouping of lakes, and by former meltwater drainage channels" (p. 192). Much more detailed fieldwork would seem necessary to substantiate this. In north Patagonia the existence of well-preserved lateral and terminal moraines near the east coast is claimed (p. 54). *Below* them, "In the cliff on the coast three openings are observable, indicating that ice lobes thrust out through them into the region now below sea level." The evidence for this is not stated. We know little of the Pleistocene stratigraphy of Patagonia as compared with other temperate areas. Unfortunately this volume does little to further our knowledge.

JOHN MERCER

EASTER ISLAND. By ALFRED MÉTRAUX. Translated from the French by Michael Bullock. *London: André Deutsch*, 1957. 8×5½ *inches; 249 pages; illustrations.* 21*s*

When the present reviewer visited Easter Island a few years ago an essential part of his luggage was a copy of Dr. Alfred Métraux's 'Ethnology of Easter Island,' one of the bulletins of the Bernice Bishop Museum in Honolulu. This substantial volume of 430 pages, published in 1940, covers in detail every aspect of its subject in the light of the knowledge then available, but it is a scientific treatise designed for the student. Dr. Métraux, an anthropologist of Swiss origin and United States citizenship, has now been well inspired to write a book for the general reader on this island that produces more problems than answers, an island even now so difficult of access that its 800-odd Polynesian inhabitants remain one of the most isolated communities of the modern world. It is the English version of the French original that is now before us. The book covers the history of the island so far as it can be elucidated, the great statues, the life, customs, religion and superstitions of the people who made them, and the state of their descendants today. Some of the fantastic theories that have been put forward to account for the singular phenomena of this remarkable place are suitably dealt with. Fascinating chapters discuss the origins of the civilization that created them and the mystery of the pictographic tablets that have never been deciphered. Since Métraux's earlier book was written, there have been fresh contributions to our knowledge of Easter Island, and fresh speculations. Thus Father Englert, the islanders' Capuchin parish priest, has written a volume embodying the results of the studies made during the many years of his devoted apostolate. Thor Heyerdahl has excavated there and has advanced fresh arguments to support his theories; Hungarian and Austrian linguists have put forward ingenious parallels between the Easter Island "scripts" and certain primitive scripts respectively of the Indus Valley and early China. All these matters are discussed lucidly and fairly in this enlightening and highly readable book, which is illustrated with photographs and drawings in the text.

H. C. LUKE

AUSTRALIA AND NEW ZEALAND

SYDNEY. By MARJORIE BARNARD. *Melbourne University Press*, 1957. 8¼×5½ *inches; 79 pages; plates.* 13*s* 6*d*

TEN STARS SOUTH OF ASIA. By DON TAYLOR. *London: Robert Hale*, 1957. 8½×5½ *inches; 190 pages; plates.* 18*s*

These two books, both about Pacific countries, are utterly dissimilar in content and the method of each author's approach. Marjorie Barnard's small volume on Sydney is a relatively scholarly, and painstaking, effort—yet it provides very agreeable reading. Don Taylor's is an essentially "chatty" and superficial account of Australia, New Zealand and Fiji—yet it contains many critical observations and much information that should be particularly valuable to anybody thinking of visiting the countries it deals with.

Miss Barnard has briefly traced the development of Sydney, the second "white" city of the British Commonwealth, from its founding as a tiny eighteenth century convict settlement and military garrison to the mid-Victorian gold-rush days (bringing population, wealth and the rise of Australia to potential nationhood), and finally to that exciting city's emergence as the intellectual and cultural "capital" of the Pacific. (A San Franciscan might dissent here, but it could be pointed out that neither San Francisco nor Los Angeles has a single good book shop; whereas Sydney has a couple not unlike Blackwell's or Heffer's.)

In passing it should be mentioned that Miss Barnard's history may be sounder than her military opinions. She believes, it would seem, that "the Battles of Midway and the Coral Sea halted invasion." In fact Midway had nothing to do with the invasion of Australia, and the Coral Sea battle stopped the Japanese from attacking (and probably occupying) southern New Guinea. The enemy was far from ever

attempting the invasion of the Australian mainland; and heaven help them had they done so.

Mr. Taylor spent about three months in the countries he writes about. He visited every Australian state and both of New Zealand's beautiful islands. A point that emerges very clearly from his book is one that few Britons appreciate—the remarkable difference in outlook on each side of the Tasman Sea. The Australians, generally speaking, have a considerable friendliness and affection for Great Britain, but a determination to carve their own destiny as an individual nation and a Pacific power. The New Zealand philosophy is utterly different. "We are English to the core" New Zealanders told Mr. Taylor. This spiritual and economic dependence on a country so far away is perhaps the chief reason why the intellectual and economic climate of Wellington and Auckland differs so much from that of Sydney or Melbourne.

A. J. MARSHALL

MR. EXPLORER DOUGLAS. Edited by JOHN PASCOE. *Wellington, N.Z.: A. H. and A. W. Reed*, 1957. $9\frac{1}{2} \times 6\frac{1}{2}$ *inches;* xx+332 *pages; illustrations, sketches, maps.* £*NZ*.1 17*s*. 6*d*

Charles Edward Douglas, the subject of this book, was awarded the Gill Memorial prize of the Society in 1897 for (the citation runs) his persistent explorations, during twenty-one years, of the difficult region of forests and gorges on the western slopes of the New Zealand Alps. His commentary on, if not his actual acknowledgement of, the award was characteristic, and his spelling quaint: "'I never shone in a Home telegram but once, and it was a tolerable speciemen. Here it is, as far as I recollect: 'The Tzar of Russia has a slight attack of influenza. Mr. Charles Douglas has been awarded the Peak prize (*sic*) for explorations in the Southern Alps. Huggings the Derby murderer has been hanged. Price of Consols 3% . . .'." Instead of money for the prize, he asked for a fixed-focus $\frac{1}{4}$ plate camera, but when it arrived it proved too complex for Douglas, and characteristically he gave it away!

This outstanding explorer of some of New Zealand's most intransigent country, during a period of thirty-seven years, was a member of a well-known and historical Edinburgh family. As a young man he arrived from Scotland in the South Island of New Zealand in 1862, and after a few years in Otago he moved to Westland, where prospecting for gold was at its height. But Douglas was far more than a mere prospector who seldom recorded where he had rambled. Douglas brought back full and valuable reports for the Survey Department, accounts which were originally, and often wittily or cynically, written and replete with descriptions of the geology, the botany and the bird life, together with his sketches and topographical maps. From years of intimate acquaintance in the bush, his knowledge of the native birds was profound. He asks the significant question: why did New Zealand not select the remarkable weka, or Maori hen, as its national symbol, rather than the stupid kiwi, which is not in the same class as regards intelligence and enterprise! In the opinion of acknowledged New Zealand experts, although without scientific training (he poked fun at scientists, as well as at others who had not actually roughed it!), Douglas's acute observations and deductions on forest ecology alone were a hundred years in advance of their time. He believed that the "vagabond" (*i.e.* wanderer) that he was, was essential to the success of a frontier society, but he was scornful of the relatively easy-going settler, the tourist and the "alpine maniac." A recluse, indeed a hermit, by nature, he had no interest in making money, though often he suffered from want; and only his remarkable physical condition and endurance (in spite later of acute rheumatism) saved him from starvation on many occasions in the difficult region of south Westland where his work lay. He died eventually in Westland public hospital, Hokitika, in 1916, aged seventy-five years.

This well-documented and well-illustrated volume is a monument to the industry and research of its editor, John Pascoe, the New Zealand mountaineer and writer, who has had access to a large collection of Douglas's papers, letters and reports,

and has received much acknowledged help from several friends and admirers of Douglas, such as A. P. Harper, W. G. McClymont, Peter Graham, Miss Mueller and others. Indeed Harper, the eminent New Zealand pioneer mountaineer (since dead), who had served for two arduous years with Douglas, provides an admirable foreword to this notable book. To the reviewer it has been a matter of particular interest perusing these pages since, apart from adventures on part of the ground, his last activity before leaving New Zealand was to fly over and photograph in 1955 (a method, incidentally, which would have been scorned by this pioneer!) much of the difficult and inaccessible mountain country that "Mr. Explorer Douglas" (his semi-official title in the Survey Department) had investigated and mapped initially with such outstanding courage and endurance. N. E. ODELL

PHYSICAL AND ECONOMIC GEOGRAPHY

LAWINEN! Abenteuer und Erfahrung, Erlebnis und Lehre. By WALTHER FLAIG. *Wiesbaden: F. A. Brockhaus*, 1955. $9\frac{1}{2} \times 6\frac{1}{2}$ *inches; 251 pages; text-figures, 82 plates. DM.16.50*

Walther Flaig published a treatise on avalanches in 1955 and the present work, a second edition, has followed twenty years later. Much more has been learnt in that time of the state of the snow cover and of the types of weather which are conducive to avalanche development. Therefore this book, which practically amounts to a new work on the subject, is welcome.

One of the best chapters is devoted to the experiences of the author and others in the mountains, the lessons and the precautions they teach. Herr Flaig is a practical man and those who go to the mountains, both for climbing and exploration, can learn much from him, particularly on the practical side.

A chapter considerably enlarged from the earlier edition is that dealing with the measures taken by the authorities to protect roads, railways and villages—a subject that has made considerable advances in recent years. Among the newer measures is the ingenious device for breaking up avalanches, not by solid ramparts but by the erection of numerous small obstructions round which the snow must flow, thus breaking and braking its energy. They are, in fact, called "avalanche brakes" (*Bremsverbauungen*).

The artificial release of avalanches by shooting them down is fully dealt with; this method is chiefly applicable to those heavy snow accumulations which come down in the same tracks from year to year.

Perhaps the most important part of the book, however, is a table at the end in elaboration of an earlier chapter showing every conceivable form of snow—"wild" snow (snow light and flimsy as flour, that falls in complete calm and at very low pressure), powder snow, firn, wind pack, etc. The table then shows the type of avalanche each would be likely to bring down under the prevailing weather conditions. This is the best way of warning the mountaineer who, before planning a tour or a climb, must make it his business to know the weather conditions for many days past and what type of snow he is likely to meet. The importance of this cannot be over-emphasized.

The book is well got up, the text, in roman print, is easily read and the illustrations are very good indeed. There is an adequate index and a very full list of references.

G. SELIGMAN

THE GALATHEA DEEP SEA EXPEDITION. Described by members of the expedition, edited by Anton F. Bruun, Sv. Greve, Hakon Mielche and Ragnar Spärck. Translated from the Danish by Reginald Spink. *London: Allen and Unwin*, 1956. 10×7 *inches; 296 pages; photographs and diagrams. 40s*

The twenty-two chapters are written by eighteen authors, all of whom took some part in the Danish expedition round the world in the *Galathea*, formerly H.M.S.

Leith, a sloop of 1600 tons displacement built at Devonport in 1934. The emphasis was on marine biology, particularly on the study of life at the greatest depths in the oceans, and the work was done mainly in the tropics and subtropics, but carried as far south as Campbell Island south of New Zealand. The book outlines the history of Danish deep-sea exploration and gives a lively account of the difficulties of raising the £275,000 needed for the new venture in 1950–2. It describes the ship and gear; the full complement was one hundred, including a scientific staff which varied between ten and sixteen and sometimes included women. The main part deals with the fauna of the deep sea, the deep-sea bottom and coastal regions, the techniques for deep-sea trawling and studying variations in productivity of the oceans, and a preliminary account of the results of echo-sounding and hydrographic work. There is an atmosphere of pioneering exploration about the book and it summarizes in an interesting way much of what is known about life in the sea. There are interesting chapters on the Nicobar Islands, Seychelles, Rennell Island and Campbell Island, and lively notes on places and people. The team took a pride in being a happy combination of naval vessel and research ship and in the fact that no other oceanographic expedition has been able to invite so many visitors to the ship for shorter or longer periods. Some of the important contributions to the work were made by visitors, such as the studies of bacteria in the deep sea by Professor Zobell, but most of the thousands who saw the ship came to see and to learn and were given every opportunity. The expedition had a public relations department which lost no opportunity of broadcasting about Denmark and the expedition, with deep-sea research as a banner, but they had much to be proud of. Experienced workers will feel that the book tends to continue this propaganda, but most readers will find it a fascinating account of the oceans and the expedition. The detailed scientific results will follow later.

G. E. R. DEACON

ONE THOUSAND METRES DOWN. By JEAN CADOUX and others, translated by R. L. G. Irving. *London: Allen and Unwin*, 1957. $8\frac{3}{4} \times 5\frac{1}{2}$ *inches; 179 pages; plates and maps.* 21*s*

CAVES AND CAVE DIVING. By GUY DE LAVAUR, translated by E. C. Mason. *London: Robert Hale*, 1957. $8\frac{3}{4} \times 5\frac{1}{2}$ *inches; 175 pages; plates and maps.* 16*s*

British speleologists who already owe a great debt to the inspiration of their French colleagues will welcome the opportunity given by these translations of becoming yet more familiar with French caves and French cavers. The Gouffre Berger is a pothole on a limestone plateau in the Vercors massif of the Pre-Alps. It was first discovered in 1953 by Jo Berger after whom it is named and the interest of speleologists throughout the world was aroused as the Grenoble section of the Spéléo-Groupe of the Club Alpin Français (S.G.C.A.F.) broke the world record for a descent in a cave by reaching −740 metres. In 'One thousand metres down' members of the S.G.C.A.F. describe the development of their group, as first one, and then another, became fired with the thrill of underground exploration. They began by exploring the Cuves de Sassenage near Grenoble and soon the enthusiasm of this group led them to investigate many potholes of their own area and elsewhere. They also spent many gruelling hours underground filming their experiences. The writers emphasize the way in which they developed their knowledge and experience as a team and it was as a team that they planned their attack on this great pothole, the Gouffre Berger, and broke world speleological records, including their own, when they finally reached −1103 metres. Any caver will easily forgive the deficiencies in literary style in order to share the experiences of the S.G.C.A.F. in exploring this fantastic pothole.

'Caves and cave diving' is by the master speleologist Guy de Lavaur and at first sight the division of the book into three parts dealing with "Potholes and underground rivers," "Sumps and vauclusian springs," and "The evolution of speleology," might lead the reader to expect a comprehensive manual on caving. This would hardly be possible in such a space and the present volume is a strange mixture

of personal reminiscence and technical detail, written in a style which is almost anecdotal. The experienced caver will particularly be interested in comparing the problems Lavaur describes with those they meet in Britain. These very differences have led to the development of many techniques in France which it is interesting to read of here. The most outstanding characteristic of this book, however, is the way in which the author describes his experiences so that the reader has a share in the thrill of exploration. At the end of each section there is a desire to know more, the natural outcome of a fascinating introduction to caving. G. E. GROOM

SURVEYS OF THE SEAS. By MARY BLEWITT. *London: MacGibbon and Kee*, 1957. 15×10 *inches; 167 pages; plates.* £10 10s

Some years ago the Hydrographic Department of the Admiralty issued, as a Professional Paper, a list of hydrographic surveys and charts of historic interest to be found in the departmental archives. The list, arranged under a number of geographical headings with accompanying text, not only revealed the great contribution made by British surveyors to the science of hydrography but also, in many cases, the surveys traced the progress of exploration, particularly in the Southern Hemisphere, during the eighteenth and early nineteenth centuries. Mere descriptive text, however, can never adequately portray documents of this nature and for a long time there has been a need for some of the more important and instructive charts to be reproduced and made available to a wider public. This Miss Blewitt has now done in a most attractive, if rather expensive, volume and so for the first time marine surveys and charts are displayed with some of the prominence which up to now has been reserved solely for land maps.

The author has divided her survey of the British contribution to marine cartography into two parts. First there is an introductory essay covering the whole field of hydrographic surveying and organization from the latter half of the seventeenth century onwards. Exploratory surveys associated with famous navigators like Cook, Bligh, Vancouver and Flinders are also accorded their rightful place in the unfolding story of chart evolution. The unhappy beginning of the Hydrographic Office under Dalrymple, culminating in his dismissal in 1808, is also recorded, Miss Blewitt being fortunate in that a number of papers, relating the circumstances in some detail, have been preserved and deposited in the Public Record Office. Documentary evidence of this nature, on the whole, is meagre and emphasizes the difficulty of the author in writing adequate commentaries for the charts and surveys which form the second part of the book. By tradition the Navy is a silent service and the surveying branch is no exception. Only occasionally do we find written descriptions and journals which make the charts spring to life. In this connection it is surprising to find that the work of George Thomas, Master, R.N., does not find a place alongside that of Mackenzie and Spence for he succeeded them in the office of Head Maritime Surveyor at the Admiralty. Thomas was a surveyor who led a very varied and adventurous life and in his early years kept a journal now preserved in the library of Southampton University. This journal records how he was shipwrecked on an uninhabited isle in the Pacific, how he collected seal skins which ultimately paid for his passage home and how the vessel bringing him to England was intercepted in the Channel with the result that Thomas found himself the victim of a press gang. In the Navy he quickly impressed with his ability to handle navigational instruments and soon found himself in the role of hydrographic surveyor. Perhaps the finest testimony to his work is that even today many of the charts of the Shetlands are based on his surveys, now well over a hundred years old.

Although most of the reproductions of the charts are taken from Admiralty sources, a few are from originals in the British Museum. The method of reproduction has inevitably meant loss of clarity especially where the original surveys have faded with age and usage. The most pleasing illustrations are those in colour drawn by Serres, the marine painter who for a time was employed in making views and sketches off

various coasts, the forerunner of the line blocks which today illustrate the Sailing Directions. The book is completed with an interesting appendix written by Lieutenant-Commander Naish, of the National Maritime Museum, about the instruments and ships used in surveying the seas of the world. A. H. W. ROBINSON

POLITISCHE GEOGRAPHIE. By OTTO MAULL. *Berlin: Safari Verlag*, 1957. $9^1/_2 \times 6^1/_2$ *inches; 624 pages; maps and plates*

This book of over 600 pages invites comparison with Isaiah Bowman's 'New World' and the recently published series of essays on political geography edited by Professor W. G. East and Dr. A. E. Moodie. The approach is similar to Bowman's in that the author deals with each country of the world in turn, but in other respects it differs considerably from both books. Its stated object is to provide a basis for judgments on political affairs, but scant justice is done to the physical basis and, indeed, frequently to the economic basis. Its approach is historical; in fact, in many ways, it is more of a broad historical world survey than a political geography. For example, nearly all the thirty-one pages on Germany are devoted to a historical survey of the growth of the German nation. This section is illustrated by five maps, all of which refer to the conditions of the nineteenth century or before. In fact, the present divided position of Germany, which the author regards as a retrogressive step in the general movement towards the unification of the German-speaking peoples, is discussed in less than three pages. British readers might well have found a detailed political geographical analysis of present-day conditions of considerable interest. The absence of such detailed considerations of modern problems and the lack of well-drawn maps illustrating up to date conditions are two outstanding impressions of the book. Indeed some of the maps are very poorly reproduced; Karte 9, for example, is scarcely legible in parts.

Perhaps the most interesting part of the book is the long introductory section in which the author analyses the various factors which have contributed to the development of modern states. He briefly considers, among others, race, self defence and trade, and proceeds to a classification of states and their physical background. Some of the classification seems rather forced but it affords an interesting contrast to the books of Bowman and East and Moodie which pay more attention to the analysis of modern problems in their geographical setting than to formal definitions and classification. R. C. HONEYBONE

LOCATION AND SPACE ECONOMY: a general theory relating to industrial location, market areas, land use, trade and urban structure. By WALTER ISARD. *London: Chapman and Hall*, 1957. $9^1/_2 \times 6^1/_4$ *inches; 350 pages; diagrams. 70s*

This work is so heavily documented that the author has left himself with little chance of expressing much original thought and few grounds for claiming that he has propounded a *general* theory of location. If this reviewer has succeeded in following Walter Isard's somewhat involved style, it appears that what he calls his general theory amounts to a theory of land use. It is based upon the assumption that there are no fundamental differences between the various types of economic activity with regard to location and distribution. All types of activity compete for space and in turn must contend with the distance factor. In this way the author claims that one can combine within one unified theoretical framework both point and areally located activities. This is certainly not an original idea, but what is interesting is the way in which he develops it by a series of diagrams and a commentary in his final chapter. The diagrams were constructed, to quote the author's own words, by means of "intuition, logic and analytical principles relating to the interaction of the general forces governing land use, and facts."

There is nothing new in this approach, geographers have for long used just such a method, but in a book which otherwise leans heavily upon the German quasi-mathematical cum-economterical approach to location, this is an odd confession to

make. As one who has occasionally engaged in what might be described as "space-manship," the stage at which all locational theories begin to break down is the point at which they begin to approach *reality*. If the author is trying to invent a twentieth-century space game as absorbing as the earliest known space game, chess, then of course he is entitled to make rules, give specific moves to each piece and limit the number of pieces in play; such a game would of course be played upon a hexagonal board with hexagonal divisions.

Geographers may at times be reproached for their insistence upon facts and the need for empiricism. They are nevertheless still entitled to point out that *space*, in the sense that the word is used by some economists (notably by the followers of the German school of location), has little meaning in real life; except, of course, for the astronomer and for the atomic physicist. Furthermore the type of example which Isard uses to demonstrate his arguments, of the kind which this reviewer calls the three point locational problem (source of raw materials, point of production, and market), is more suited to the nineteenth than to the twentieth century. When industry meant little more than iron, steel, coal, textiles and shipbuilding, the Weberian approach might have been useful, but when we consider, for example, that in the United States of America only a third of the total population is gainfully employed, that of these more than a third are concerned with service industries, and that mining and quarrying between them employ less than one million persons, we must begin with fresh ideas. Isard is probably right in pointing out the relevance of the Loschian approach and the importance of site and distance in bringing about land use patterns, but he is wrong in assuming that the location of economic activity is always a question of the captains of industry juggling with space. It is in many ways a great pity that Walter Isard did not give us instead a straightforward account of the development, and an interpretation of, the German school of location, since with the notable exceptions of Weber and Losch few of their works have been translated into English. Perhaps then we might more clearly understand what all the fuss is about.

MARTYN J. WEBB

GÉOGRAPHIE DES TEXTILES. By A. ALLIX and A. GIBERT. *Paris: Éditions Génin, Librairie de Médicis*, 1957. 10×6½ *inches;* 564 *pages; maps, diagrams, plates.* 3300 *frs.*

This book deals with both natural and artificial textiles and covers the geography of raw material production, manufacture and trade. There are three parts; a general background survey, a study by commodity and an account of manufacturing by country. The reader interested in the location of industry will find a chapter on "localisation" in Part I, sections on the world distribution of particular industries within the chapters on cotton, wool and other commodities in Part II, and a regional treatment in Part III. The study of cotton growing and other natural fibre production is confined to Part II.

The coverage is world wide and much attention is given to historical development. Topics usually receive a more generous amount of space than in standard economic geography textbooks. There is a wealth of comparative material drawn from scattered sources against which familiar generalizations may be tested. The contrasts between spinning and weaving, for example, emerge forcefully. Particularly good features include the account of silk production and the study of industrial and corporate structure. Useful maps and a liberal allocation of pictures make the book attractive. There is also a valuable assemblage of post-war statistical data.

In a work of this size some unevenness of treatment is to be expected. In the regional section France receives 34 pages, Britain 19 and Germany only 6. For the English reader the thorough and well documented digest of material on French textile manufacturing should prove invaluable. On the other hand, the section on the United States is disappointing in view of the extensive literature on the decline of New England and the growth of the South-east. Only two American writers appear

in the appropriate bibliography (p. 447). The chapter "Affranchissements et promotions en cours" contains much unfamiliar and up-to-date information on developments in South America, Africa and other new textile manufacturing areas. Some errors are inevitable. It is surprising (p. 239) to find Oxford and Gloucester classed as new centres of the woollen industry "dans l'Ouest du bassin de Londres" and Nagoya is unaccountably missing from the map of Japan (p. 455).

This is the only comprehensive geography of textiles. It has many great merits and should prove particularly valuable as a reference book. J. E. MARTIN

MISCELLANEOUS

IN AN ARTIST AMONG MOUNTAINS (*Hale*, 1957, 21*s*), Mr. V. Coverley-Price compresses his extensive travels among the world's high mountains into a mere 224 pages, and the result is little more than a catalogue of places visited and painted. Style is the first victim of the desire to omit nothing, and superficiality of information its offspring. The thirty-three water-colour illustrations augmenting the text are reproduced in monochrome, a circumstance which would have mattered more if mountain-painting technique had been under consideration. As it happens, autobiography triumphs, the only concessions to the book-title being a few paragraphs (pp. 32, 55, 89, 214) revelatory of the author's contempt of photography as a means of mountain portrayal, as of his opinion that "if the artist . . . is also a mountaineer, he has an advantage over others who have never climbed." Inevitably, some readers will test these propositions by a reference to Mr. Coverley-Price's own pictures. It is unlikely to be photographers only who will feel that Tairraz, Sella, and Roch have nothing to fear from the comparison, while not a few of the pictures reveal the shortcomings the author detects in the work of non-climbing painters of mountains—"rocks that are wooden stage-props, and snow that is clearly paint." The case for paint or photography is surely an insoluble question of aesthetics, and it would require a Ruskin, Turner or Clarkson Stanfield (none of them climbers) to tempt mountain-lovers from a wise neutrality in the matter.

Mr. Norman Hardie explains in the preface to IN HIGHEST NEPAL (*Allen and Unwin*, 1957, 21*s*) that his subject is Sherpas, "unsullied by science and as yet unspoiled by western civilisation." The result is an entertaining book about the Sherpa communities of Sola Khumbu, which the author visited after the successful Kangchenjunga expedition. Accompanying him on his long journey were the Sherpas Urkien and Gyaleng, and as harbingers of good news—the mountain climbed and the Sherpa menfolk safe—the trio was fêted at each village. The author withstands the endless *chang* drinking with admirable fortitude and portrays the ready laughter, the dignity and reliability of his subjects, in a neat and simple way. Implicit in the book is the change wrought in the lives of the Sherpas by successive expeditions. The great peaks, once only objects of devotion, have become more familiar; portering is an important feature of the economy of Sola Khumbu. The innocent spoils, like the vintage oxygen bottle sounded in one village to summon the devout to prayer, suggest that, up to now, the westernization Mr. Hardie fears has not been on a scale nor of a kind likely to confuse or corrupt. He and his kind seem to confer at least as much happiness as they receive. The photographs in the book are excellent.

A more sophisticated narrative is A. Azema's CONQUEST OF FITZROY (*Deutsch*, 1957, 21*s*) which goes far to redress the terseness and stylistic nonchalance blighting so much French mountain literature of late. Chapter II, which places the peak in its Patagonian setting, captures vividly the desolation of the FitzRoy massif and the ferocity of the Pacific gales which pound it. Having set his stage, M. Azema then considers those who have ventured upon it between the Agostini reconnaissance of 1935 and the advent of his own party nearly twenty years later. The book culminates in the ascent by Terray and Magnone of FitzRoy's great spire, courageously accomplished and graphically described. Then, after criticizing the British weakness for

calling summits after men who have nothing to do with their conquest, M. Azema and his friends catch the contagion and name two unclimbed satellites of their peak after their drowned colleague, Poincenot, and the aviator, St. Exupéry. The translation from the French, by Katharine Chorley and Nea Morin, is brilliantly done; the photographs are a little disappointing; the numerous maps are never where they ought to be and the contents page does not acknowledge their existence at all.

A. B. CUNNINGHAM

THINGS WORTH WHILE. By EVELYN CHEESMAN. *London: Hutchinson*, 1957. $8\frac{1}{4} \times 5\frac{1}{4}$ *inches;* 330 *pages.* 21*s*

The early part of the author's life seems to have been a period of preparation and waiting for what eventually became her life work. As she herself says, "For the majority of people there seems to be one part of the globe that holds special allure. . . . For them the rest of the world holds only secondary interest." In Miss Cheesman's case this proved to be what is commonly known as the South Sea Islands and after a succession of expeditions to various parts of Oceania, she describes the people, fauna and flora, as well as the islands themselves, in a graphic and interesting fashion.

The description in the early chapters of life in a typical English country house during the latter part of the late century will bring nostalgic memories to those old enough to have experienced the gracious living and leisurely existence among the so-called privileged classes. However, this was not sufficient for Miss Cheesman who even in childhood found her vocation with the animal kingdom, and tried to become a veterinary surgeon. At that time women were not admitted to the Royal Veterinary College, so, as a substitute, she became a trained canine nurse. During the First World War she served as a temporary civil servant in the Admiralty and after the war was appointed Curator of Insects at the London Zoo. Then in 1923 she had the opportunity of going on the St. George Expedition to the Galapagos Islands, Marquesas and Society Islands. On her return to England in 1928 she joined the British Museum (Natural History) and then took part in a series of expeditions to the South Sea Islands, mainly for the purpose of collecting insects. The last of these expeditions, to Aneityum in 1954/55, was undertaken when she was well over seventy.

The whole book reads like an adventure story and anyone with the spirit of adventure will read it with pleasure. The author has been very generous with her readers for there is sufficient material packed into these 300-odd pages to make half a dozen equally delightful books. The only minor criticisms one may offer are the lack of illustrations, apart from the frontispiece, and the absence of an index.

EDWARD HINDLE

THE RENDERING OF GEOGRAPHICAL NAMES. By M. AUROUSSEAU. *London: Hutchinson University Library.* 1957. $7\frac{1}{2} \times 5$ *inches;* ix+145 *pages.* 10*s* 6*d*

The nature of this excellent little book may be indicated by one citation from it: "Even in a country geographically so well ordered as France, a name may be written in one way by the Post Office but in another by the Railway Administration" (p. 34). The book is in fact a clear and concise account (in semi-popular form) of a difficult and obscure problem, namely, what is the "right" way for an employee of one Sovereign State to write the name of a geographical entity situate in this one or in another? For, since the prime interest of such writings is precisely to such persons, we can safely go on to recommend that all other writers (*e.g.* historians, geographers and philologists) should, in these matters, strive always to follow the practice of their governments. The various materializations of this problem (not all of which, naturally, have been considered by Mr. Aurousseau) differ enormously in difficulty as may be seen by the following examples (which I arrange in ascending order of difficulty):

Writer's nationality	*Location of geographical entity*	*Language to which name of geographical entity belongs*
1. British	U.K.	English
2. British	U.S.S.R.	Russian
3. British	U.S.S.R.	Samoyede
4. British	U.S.S.R.	[Unknown]
5. Russian	U.K.	Welsh
6. British	Japan	Japanese
7. British	Japan	Ainu
8. Yemeni	Japan	Japanese
9. Yemeni	Japan	Ainu

Mr. Aurousseau sets out his—really fascinating—basic problem very clearly: two short chapters (I–II) on definitions; Chapter III "Systems of Writing," Chapter IV on transliteration and the like; Chapter V is an excursus on "The identification of places" (systems of coordinates, etc.); in Chapter VI there are discussed the various English usages in the matter; in Chapter VIII, attempts at international usage. Throughout, the work is well documented (many of the references seem unbearably antiquated but this may mean no more than that the subject has received so little attention).

In Chapter VII, Mr. Aurousseau puts forward his own recommendations for English usage (wisely, in Chapter VIII, he feels rather unable to formulate international rules). The essential of the book is thus these "English" rules (pp. 92–5) and a reviewer should clearly concentrate on them. In the main they are good rules and I have only three comments to make.

(1) "3. Explorers, travellers or surveyors, when recording unwritten geographical names in the field, should endeavour to do so by the scientific methods now employed for the phonetic recording of speech, failing which, a record in the symbols of the International Phonetic Association should be made, or in the vernacular alphabet if there be a suitable one in use." This is "nice for us but not for them."

(2) "5. . . . (*b*) In countries which officially use varieties of the Roman alphabet all geographical names but those of the kinds mentioned in (*a*) [*i.e.* conventional English nomenclatures, as *Paris*] shall be adopted without change in their official forms"—and it is clear, by reference to para. 6(*b*), that Mr. Aurousseau here means "complete with diacritics." Mr. Aurousseau is obviously no typographer or he would know that his suggestion is quite impracticable because of the notorious lack of peculiars manifested by all printers except philological ones.

(3) "5. . . . (*e*). In historical context the name of any part of the world, geographical feature or place shall be that which it bore in the region and language concerned, at the time under consideration; or, a received transliteration or English transcription of that name, were it originally written in a non-Roman alphabet or script." There is certainly something wrong here, for, applying the rule, we see that we must translate an entry in the Anglo-Saxon Chronicle, *s.a.* 1011, as "They had then overrun Eastengle and Eastsexe and Middelsexe and Oxenafordscir and Grantabrycgscir . . ." as Mr. Aurousseau does not allow us to use *East Anglia*, *Essex*, *Middlesex*, *Oxfordshire*, *Cambridgeshire* here.

On the whole, there is much to praise and little to criticize in this book. I offer a few additional comments.

(*a*) Mr. Aurousseau is not a philologist (though he is to be congratulated on his sound views on the concept *Phoneme*, p. 37) and there are many minor points to which a philologist will object; thus, p. 36, Mr. Aurousseau confuses *tone* and *accent*; at p. 53, he uses the meaningless (but widespread) terms *hard*, *soft*, *liquid*; and the statement (p. 19) "Chaucer . . . spelled only two foreign names as they are spelt today: Jerusalem and Rome" reads very bizarrely.

(*b*) Mr. Aurousseau has done philologists a service in defining the class of *exonyms*

(pp. 17 ff)—such as *Leghorn*, an English name for a foreign place (*Livorno*); this important class has been but little studied by toponymists. But he nowhere makes plain his distinction between "conventional" and "anglicised" English exonyms of foreign origin (p. 27).

(*c*) "Neither are we likely to be greatly concerned with what Estonians call places outside Estonia" (p. 29). But surely it is only in practice that the fact that *Sverige* is called *Rootsi* by the Estonians is less important than that it is called *Sweden* by the English; in theory (and Mr. Aurousseau, staunch methodologist that he patently is, is dealing with theory), the two facts are of precisely co-equal status.

Mr. Aurousseau's fundamental little book will be of interest to the most diverse readers and it is much to be hoped that its appearance will stimulate further consideration of his basic problem. Since there is an essential philological component inherent it it, the first step towards this further consideration might well be that the International Congresses of Toponymy and Anthroponymy (aided, perhaps, by UNESCO) should take more notice of the problem than they have done hitherto.

ALAN S. C. ROSS

INTERNATIONAL GEOGRAPHICAL UNION. Proceedings of the Eighth General Assembly and Seventeenth International Congress. Washington, August 8–15, 1952. *Washington: United States National Committee* [1957]. 10×7 *inches;* xiii+776 *pages; maps and diagrams*

The Washington meeting of the International Geographical Union was held as long ago as August 1952, but its proceedings have only just been published. For obvious reasons a five-year delay in the appearance of the collected papers of such an important meeting has been most unfortunate. The results of recent previous congresses have been printed in several separate volumes, each book being generally devoted to work in one or two allied branches of geography. On this occasion there has been a reversion to the older practice of collecting all the results of the meeting into one comprehensive volume.

This large and heavy book of 776 pages is sumptuously produced on glossy paper, carefully edited and well illustrated but it is very difficult to use. The only index is an index of names of authors without their papers. There is no detailed table of contents giving the title of each paper printed, so that papers are in real danger of burial in the volume, admittedly a common fate for work at international conferences. The preliminary matter does give a diary of all the papers read at the meeting, but it should be noted that not all the papers read to the Congress have been included in the volume, while some papers presented by title only have been printed. Further, some papers already published elsewhere during the long delay since the meeting have not been printed in this volume, but in such cases a bibliographical reference is given to the source where the paper has appeared. These arrangements are not entirely satisfactory and the collection of *Abstracts of Papers*, printed as *Publication No.* 6 in 1952 before the meeting was held, is still most useful. This book of 102 pages includes the abstracts of a number of papers actually read at the Congress but omitted from its *Proceedings*. Nevertheless it is unfair to cavil at these details that are all primarily due to the extraordinary and inexplicable delay in publication. Geographers should be grateful for this collection of work by eight commissions, twelve sections and one committee as well as the accounts of the two symposia on Tropical Africa and on World Food Supply.

E. W. GILBERT

SHORTER NOTICES

EAST NORWAY AND ITS FRONTIER was the last of the regional histories of Norway to be published by the late Commander Frank Noel Stagg (*Allen and Unwin*, 1956, 25*s*). Like its predecessors this attractive volume is beautifully illustrated; the subjects of the

excellent photographs vary from the architectural to the archaeological, and a number of historical portraits are included. EAST NORWAY is concerned to a large extent with the history of Oslo from earliest times until the twenties of the present century—a story which has never been told in English, and which will be welcomed in this pleasant form by the many Englishmen who love Norway.

Duckworth's are responsible for publishing in this country a very handsome book of photographs of Holland, with text in English, French and Dutch. THE NETHERLANDS IN PHOTOGRAPHS (*Duckworth*, 1957, 21*s*) provides an excellent overall view of Holland; many of the photographs are from the air, and bring home to one the typically compact nature of the countryside, with every inch cultivated. The text by C. J. Kelk and the pictures by *Cas Oorthuys en Aero-photo Nederland* are mercifully free from the quaint and the "corny," and some of the architectural pictures are particularly good. D. M.

DOG IN THE SNOW, by James Riddell (*Michael Joseph*, 1957, 12*s* 6*s*) is a very light, short book by the former commanding officer of the wartime British Army School of Skiing and Mountain Warfare in Lebanon. The dog of the title was the author's pet Alsatian. Anyone who likes skiing and/or dogs, specially if he knows and likes Lebanon too, will find a pleasant evening's reading here.

Claudie Fayein's A FRENCH DOCTOR IN THE YEMEN (*Robert Hale*, 1957, 21*s*) describes her life and work in Sana and elsewhere in Yemen. Mme. Fayein is an enthusiast of ethnology, "the present-day excuse of the adventurous," a marxist and an atheist, and her book has a pungency lacking in many Anglo-Saxon travelogues. She set out to dig deeply below the surface of Yemeni life, was determined not to be put off, and succeeded in developing an unusually intimate acquaintance with many aspects of the life of her patients, male and female. She puts down her experiences boldly.

N. L.

A lovely picture of the Taj Mahal upside-down in still, lily-strewn waters, sets the tone for Austin Coates' random, and often unexpected, reflections on the East which make up PERSONAL AND ORIENTAL (*Hutchinson*, 1957, 25*s*). Of the Eastern nations, India (specially Bengal) is his love, but Mr. Coates has some wise and considered observations to make on Japan, China, the Philippines, Burma, Pakistan and Turkey. Of course he is not equally at home in all these countries, but he is always easy to read because he approaches things from a personal angle, and he has many friends.

Mr. Colin Simpson, an Australian journalist who made his name by books on the primitive peoples of New Guinea and elsewhere in the Pacific, has turned his attention to modern Japan. There is little for the expert in PICTURE OF JAPAN (*Angus and Robertson*, 1957, 21*s*), a briskly written and beautifully illustrated book, but the ordinary reader will find much to enjoy in it, and may even learn something new.

Herr Hans Grieshaber, a Swiss business man, has travelled through the Americas, Australasia, Asia proper and Africa, and has incorporated his best remembered adventures in a profusely illustrated book with the title of THIRTY YEARS TRAVELLING ROUND THE WORLD (*Hale*, 1957, 21*s*). His bibliography of guidebooks will be useful to many intending travellers. D. M.

THE SOCIETY'S NEWS

MONUMENT TO OTTO SVERDRUP

On 21 July 1957 a monument was unveiled at Steinkjer in Norway, to the memory of Otto Sverdrup, the distinguished Arctic explorer and Gold Medallist of the Society. Superintendent H. A. Larsen of the Royal Canadian Mounted Police, also a Gold Medallist of the Society, represented the Canadian Government at the ceremony, and undertook to deliver the following message from the President and Council of the Royal Geographical Society.

"On this occasion of commemoration of Captain Otto Sverdrup, the President and Council of the Royal Geographical Society wish to pay tribute to the memory of the great Norwegian Arctic explorer, who was a recipient of the Society's Royal Medal. Otto Sverdrup will always be remembered in this country as a prince of Polar navigators whose great achievements, following on those of Nansen and Amundsen, have helped to make Norway one of the leading countries in the world in Polar exploration and research. It is not only Otto Sverdrup's remarkable journey in the *Fram* which will be remembered by posterity, but among his other achievements his great explorations to the west of Ellesmere Island. These added to the geography of the Arctic immense lands which were charted by Otto Sverdrup with all the care and accuracy which characterized his work.

"For many years the Royal Geographical Society, and indeed British Polar explorers throughout the world, have had close and cherished ties with Norway in Arctic and Antarctic work. Today's ceremony offers the Society a most welcome opportunity, not only of commemorating a great Polar explorer, so much admired and so highly regarded in Great Britain, but also of expressing the wish that cooperation between British and Norwegian Polar explorers and scientists will continue to flourish and prosper."

It will be remembered that Otto Sverdrup received the Founder's Medal at the meeting held by the Society on 27 April 1903 for discoveries in what is now the Canadian Arctic, over an area now known almost to exceed in total extent all the discoveries of the Franklin Search expeditions.

GEOGRAPHICAL SOCIETY OF CHINA

News has been received from Mr. Stephen Chaplin of Enfield Cables Ltd., of the Geographical Society of China. Mr. Chaplin, who has just returned from a visit to Russia and China, carried to Chinese geographers a message from the R.G.S. and brought back greetings from them. The Geographical Society of China, of which the address is Wen Chin Chu 3, Peking, has 1300 members. The Vice-President is Dr. Sun Ching Chie and the Director is Dr. Huang Ping Wei. There is also an Institute of Geography at Nanking (of which the address is Academica Sinica, Chin Hua Shan) with some seventy members. Members of the Society, concerned especially with the application of geographical techniques to current economic and industrial problems, fall into six groups, dealing with climatology, physical geography, cartography, geomorphology, hydrography and economic geography. Mr. Chaplin brought back with him for the Library and Map Room two issues of the Chinese Society's 1957 *Journal*, and a small sectionalized atlas of China, purchased in Peking.

GEOGRAPHICAL SOCIETY OF VIENNA

The Director and Secretary of the Society, Mr. L. P. Kirwan, has been presented, through the Austrian Embassy in London, with Honorary Corresponding Membership of the Geographical Society of Vienna, for services to geography and archaeology.

APPLICATIONS FOR GRANTS FOR EXPLORATION AND RESEARCH 1958

Applications for grants for both exploration and research must reach the Director and Secretary not later than **1 March 1958**; it is only in very exceptional circumstances that later applications can be considered. Applications must be *typed* on the Society's own form which can be obtained on request; they must be accompanied by evidence of support from institutions or qualified individuals supporting the proposed expedition or research. Leaders of expeditions and other applicants for grants may be expected to attend an interviewing board.

GEOGRAPHICAL ESSAY PRIZE

The prize for 1957 has been awarded to J. R. Coull of Aberdeen University for his essay on "Southern Shetland: a study in geographical dynamics." Mr. P. W. L. Turner of Jesus College, Oxford, has been named as *proxime accessit* for his essay "Water resources and water supply in Britain." A prize is offered of £10 for the forthcoming year for the best geographical essay not exceeding 5000 words in length, including sketch-maps and diagrams, written by a student reading geography at a university in Great Britain or Northern Ireland during the academic year in which the essay is submitted. The closing date for entries is 15 June 1958, and the Council reserves the right to publish or to retain for the Library any of the essays received.

GENERAL CERTIFICATE OF EDUCATION: GEOGRAPHY PRIZES

The award each year by the Society of prizes for geography based on the results at Advanced and Scholarship levels in the General Certificate of Education summer examinations, was announced in the *Geographical Journal*, December 1956, p. 519. This year Northern Ireland was included, and the awards, on the recommendations of the respective Boards of Examiners, have been made as follows:

Oxford Local Examinations: Brenda J. Turner, Wyggeston Girls' School, Leicester. *Oxford and Cambridge Schools Examination Board:* (Mr.) J. A. P. Ray, Ellesmere College, Ellesmere, Shropshire. *Joint Matriculation Board, Manchester:* David C. Walker, Manchester Grammar School, Manchester. *University of Durham Schools Examination Board:* Peter E. Sanderson and David E. Sayburn, Royal Grammar School, Newcastle-upon-Tyne, jointly. *Southern Universities Joint Board:* Margaret G. Bradley, Colston's Girls' School, Bristol *Senior Certificate Examination, Northern Ireland:* Rosemary H. Marshall, High School for Girls, Dungannon. *Welsh Joint Education Committee:* Herbert O. Slaymaker, Bishop Gore School, Swansea. *University of London School Examinations Council:* John R. Marshall, Brockley County School, London, S.E.4, and David E. Keeble, Taunton's School, Southampton, jointly. *Cambridge Local Examinations:* Joan A. Wheeler, Bournemouth School for Girls, Bournemouth.

THE RECORD

CONTRIBUTORS TO THIS ISSUE OF THE *JOURNAL*

John Kempe led the reconnaissance of Kangchenjunga in 1954 which prepared the way for the successful expedition in the following year; *George Band* and *Michael Westmacott* were both on the Everest Expedition 1953. *A. H. W. Robinson* is lecturer in the geography department, University of Leicester. *Wilfred Thesiger*, D.S.O., Gold Medallist, is well known for his travels in Arabia and Afghanistan. *J. E. G. W. Greenwood* is in the Photogeological Section of the Directorate of Overseas Geological Surveys; his article was suggested by ground observations in the Somaliland

Protectorate during geological work in 1955–6. *J. N. Jennings*, reader in geomorphology in the department of geography, Australian National University, Canberra, visited King Island three times in 1953–5 for field work. *R. A. Hamilton*, Air Ministry meteorologist, was Chief Scientist on the British North Greenland Expedition 1952–4; *Lieutenant-Colonel C. A. Biddle* is lecturer in surveying at University College London; *B. W. Sparks* is lecturer in geography in the University of Cambridge. *Gerald de Gaury*, author of 'Arabia Phoenix' and 'Rulers of Mecca,' was Political Agent at Kuwait, 1936–9, when he made the first journey by a European direct from Kuwait to Jordan. *Ronald S. Waters* is lecturer in geography in the University of Exeter. *Dr. Edward Hindle*, F.R.S., is the Society's senior Honorary Secretary.

UNIVERSITY NEWS

UNIVERSITY OF BRISTOL: UNIVERSITY OF LEEDS

Professor R. F. Peel has moved from the department of geography in the University of Leeds, to Bristol. Here he takes up the chair of geography vacated by Professor W. W. Jervis. Dr. F. J. Fowler, senior lecturer, is for the present acting head of the geography department at Leeds.

UNIVERSITY OF CAMBRIDGE

Professor Steers' visits to South America stimulated our interest in that continent and were followed by the addition of Spanish as an option in the translation paper in the Preliminary (first year) Examination in Geography, and by C. T. Smith's visit to Peru in the summer term and long vacation, 1957. A. L. Caesar spent the academic year 1956–7 at Bloomington in the University of Indiana, partly as an exchange with Professor Pounds who has been in Cambridge most of the year. Mr. Caesar also travelled widely in the United States and Canada. Mr. C. A. Fisher and Dr. M. J. Wise also lectured in Mr. Caesar's absence. B. H. Farmer's appointment by the Ceylon Government as a member of the Land Commission took him to Ceylon, India, Pakistan and South-east Asia for the year 1955–6, and again to Ceylon for the Easter Vacation 1957. His book on Ceylon has now been published, and the findings of the Land Commission have been published in an official report. Mrs. Steers' book on Czecho-slovakia and Miss Mitchell's book on historical geography have also appeared since our last note was printed in the *Journal*. A further visit to Africa has been made by A. T. Grove this long vacation. He has crossed the Sahara to Tibesti to examine the physical geography of that little-known region, on an expedition led by Dr. Akester. South and east England and northern France have been the *venue* of B. W. Sparks in his studies of glacial and post-glacial deposits, with special reference to their dating by the non-marine mollusca and to the terraces of the Cam Valley. In much of this work he collaborates with Dr. R. G. West of the sub-department of Quaternary research, Cambridge. Successful attempts to trace the longshore drift of pebbles beyond the low-water mark by radio-active methods have been made, under the initiative of Professor Steers, off Scolt Head Island and at Orfordness. Mr. C. D. Kidson, of the Nature Conservancy, has continued and expanded the work. W. W. Williams has continued his observations on coast erosion in the Southwold area, including levelling down the beach and into the sea to a depth from which the profiles could be continued seawards by echo-sounding. The glacier research programme in Norway has continued; the physicists, in particular, have obtained good results from the general and specialized survey work. The pipeline that was melted into the glacier in the summer of 1956 was buried when visited at Christmas-time, and was still buried beneath a great avalanche fan of ice from a neighbouring tributary glacier in July 1957. Thus no re-survey could be made. J. E. Jackson, who has been active both in directing most of the survey work in Norway, and in the administration of this series of expeditions, attended the meeting of the International Union of Geodesy and Geophysics Conference in Toronto this September. Dr. D. P. J. Wood was a member of the Cambridge North Borneo Expedition in the long vacation, 1956.

Undergraduates from this department took part in this and in many other expeditions visiting widely different parts of the world.

J. H. Paterson left the department in 1956 and accepted a lectureship in the University of St. Andrews. He was succeeded by Dr. E. A. Wrigley, a Bye-Fellow of Peterhouse, Cambridge. Dr. D. P. J. Wood left in October and we have been joined by P. Haggett, who returns to Cambridge from a post at University College London.

The Scott Polar Research Institute has been incorporated more closely into the University by being made a sub-department of the department of geography. Professor Steers succeeded Sir James Wordie as chairman of the Committee of Management, and is acting as Director until the newly appointed Director, Dr. G. de Q. Robin, returns to England from Canberra. Professor W. V. D. Hodge, F.R.S., is chairman of the newly constituted Advisory Committee to the Institute.

An increasing number of students proceed, after graduating, to the University of Wisconsin including, during the coming session, Miss A. M. Luckhurst who has been awarded a King George VI Memorial Fellowship. Professor Trewartha's visits to Cambridge, which we greatly appreciate, have encouraged this link with the University of Wisconsin. The department of geography at the University of McGill, Montreal, with its association with the Arctic Institute of North America, is proving a similar welcome attraction to graduates interested in glaciology, some of whom have subsequently accepted posts in Canada. W. V. LEWIS.

DURHAM COLLEGES IN THE UNIVERSITY OF DURHAM

Since the last note on this School appeared in the *Journal*, there has been considerable expansion in numbers and activity. Students reading for an honours degree now number about one hundred; and a recent innovation has been the opening of a separate research section equipped with a drawing office, soil-analysis laboratory, and conference room, in addition to accommodation for the fourteen full-time research workers attached to the section. Principal but by no means sole emphasis in research has been on the Mediterranean area. The departmental interest in the Middle East was last year recognized by the grant of £17,000 by the Rockefeller Trustees, and this allowed *inter alia* the appointment of three full-time Fellows who are now working in Libya and Jordan. For some years a project involving aspects of the geography of Malta has been under way, with financial support from H.M. Colonial Office, the Government of Malta and Durham University. During the last three years parties of field workers have visited the archipelago to undertake surveys; and during April 1957 eleven members of the department were working in the islands—altogether some twenty-five undergraduates and staff have been able to take part in these visits. The Government of Malta has invited a continuance of the investigations over the next few years; and one other feature of the Malta programme is the close collaboration with the Royal University, Valletta.

A provisional report on findings in Malta was published in 1955, and requests for copies of this outran available supplies. It is intended ultimately to publish a further statement on Maltese agriculture (incorporating a complete land use survey of the archipelago). A further innovation is the starting of two series of departmental reports: one an occasional series on particular topics (a study of Edale has already appeared, and the next will consider subjectivity in cartography), the other on specific research items. The first of these is expected to be a summary of the fifteenth century historical geography of the Durham Palatinate, including a translation of the Langley survey of 1418.

Current research work involving local field investigation hence falls into several distinct groups: (*a*) agricultural development and potential—with topics involving Malta, Libya, the Sudan, Kuwait, the upper Wear valley and the Jurassic scarps of England; (*b*) social relations (Malta, the Tibesti area of Libya, Amman); (*c*) economic development (Malta, Indiana U.S.A., Denmark); (*d*) physical (the hydrography of the Wear, the coastal formations of County Durham); and (*e*) historical geography—the

last being based upon the extensive collection of Dean and Chapter MSS. located in Durham. As the county was a Palatinate in some respects independent of the Crown until 1837, many early surveys of this region are housed in Durham.

Most recent developments in teaching include the starting of courses in soil science and agricultural geography, and extended interest in climatology and elementary meteorology. Particular scope for these topics is afforded by the Pennine–Cheviot moorlands less than an hour's journey from Durham—an attractive but relatively unknown area with the lowest population density of any major region of England. Longer-standing connection continues with anthropology, economics and surveying, so that subsidiary courses in these subjects may be included as options in the honours degree. Field work of various kinds continues as an integral part of the undergraduate courses. Over the past few years visits have been made to Tours, Tübingen, Aberystwyth, Edale, Swanage and St. Andrews; and there is a scheme of local visits which takes in activities between the Roman Wall and the Cleveland industrial area.

The special circumstances of the Durham Colleges as entirely residential draw a wide range of entrants from most parts of Britain. Durham is thus far from being entirely a regional university, and the varied geographical origin of undergraduates is a valuable feature. There is also a balance between departmental and college loyalties —the Geographical Society has its sporting activities and social functions, at which chief guests have been Sir Alexander Fleck, Lord Tweedsmuir, and Dr. Sam Watson.

W. B. FISHER

UNIVERSITY COLLEGE OF SWANSEA: AN EXPERIMENT IN THE TRAINING OF CARTOGRAPHERS

In a recent number of this *Journal*, Professor Balchin mentioned the inception of a course in advanced cartography held in the geography department of the University College of Swansea (*Geogr. J.* **123** (1957), pp. 120–1). The enquiries made as a result of this note suggest that a more detailed statement will be of interest.

Despite the advances which were made in map production during the war, and despite the great post-war increase in the use of all kinds of maps, there is still no recognized civilian centre which can provide training for the graduate cartographer. There are really only two criteria by which the proficiency of an individual may be gauged. One is that he has been trained at the School of Military Survey; the second is his experience gained in working for firms or government departments. At present the majority of survey establishments recruit most of their cartographic staff as apprentice draughtsmen of school-leaving age. Experience is a vitally necessary qualification for the draughtsman or operator of one of the more elaborate photogrammetric plotting machines, but their work is often routine and can be carried out without a theoretical knowledge of the subjects. There are, however, comparatively few draughtsmen or photogrammetric plotters who can carry out the more exacting work of map compilation. This is essentially work for the graduate cartographer.

Since cartography is seldom taught beyond a very elementary level at most universities, an honours degree in geography is no indication that the individual knows anything about the subject. Indeed, the experience of the Hydrographic Department and Military Survey during the war revealed that few geography graduates were acquainted with any of the problems and techniques of preparing maps or charts. This defect in the training of geographers was noted as long ago as 1944 (*Nature*, **154**, 3896 (1944)), but during the post-war decade little attempt has been made to introduce students to the technology of map production. During this period there have been considerable advances in the teaching of practical geography, but in every department present trends indicate an emphasis on teaching the application of cartographic techniques to the representation and illustration of geographical distributions and relationships. Too often the student's practical knowledge is measured solely by his ability to interpret the physical and human geography depicted on a topographical map. A recent letter in this *Journal* (*Geogr. J.* **122** (1956), p. 403) has revealed that many students live in happy ignorance of elementary map projection.

The object of the course at Swansea is to train suitable geography students in some of the techniques of map compilation which are indispensable to the graduate cartographer. The work thus bears the same relationship to the typical honours syllabus as the special aspect courses in topographical and geodetic surveying available at Bristol, Cambridge and Newcastle. At present the course is available for undergraduates as a special option during their final honours year and for postgraduate students. Last year, the provisional syllabus of this course was circulated among those government departments and private companies which are primarily concerned with the publication of maps. The present writer was able to visit many of these establishments in order to ascertain what kind of training was considered to be desirable. From the conflicting claims for specialized training in certain limited aspects, it has been possible to evolve a syllabus which includes the following major topics: (1) Extent of world map cover; (2) survey computations and adjustments; (3) advanced study of map projections; (4) photogrammetry; (5) techniques of map compilation; (6) techniques of map draughting and map reproduction. The practical work associated with the course includes two major exercises; first, the investigation of the topographic map coverage of a single continent; second, the compilation of part of a topographical map on a scale of 1 : 250,000.

D. H. MALING

THE CENTENARY OF THE ALPINE CLUB

To the Alpine Club, on the occasion of its centenary this year, the Royal Geographical Society offers its warm congratulations, and wishes it continued and increasing prosperity. As the following note recalls briefly, the two bodies have worked closely together in the past, and the Society looks forward confidently to the continuance of this cooperation.

The centenary celebrations included a reception in the Great Hall of Lincoln's Inn on December 9, at which H.M. The Queen and H.R.H. Prince Philip Duke of Edinburgh graciously consented to be present. At the Annual Dinner on November 6, Sir James Marshall-Cornwall, President R.G.S., proposed the health of the Alpine Club. During November there was an exhibition of pictures, books and other objects of interest connected with the Club's history. This was opened by H.R.H. the Duchess of Gloucester.

The dinner was held exactly one hundred years after that given by William Mathews at his residence in Worcestershire, when the formation of the Club—the first of its kind—was discussed. Three other members of the Mathews family were then present with E. G. Kennedy who organized and presided over the first meeting at Ashley's Hotel, Covent Garden, on 22 December 1857, when eleven original members attended.

By this time British climbers were active in Switzerland, largely attracted thither by J. D. Forbes' 'Travels in the Alps.' The years which followed have been styled "the glorious summer of mountaineering for those able to go to the Alps," and the club prospered accordingly. British climbers were drawn originally from the professional classes trained at school and college to athletic pursuits and enjoying a long summer holiday. For them, mountaineering in the Alps went hand in hand with exploration, for the remoter areas were still little known to the outside world. At an early stage, also, their attention was drawn to opportunities in the Carpathians, north-west Spain, Iceland and, a little later, the Caucasus. The development of mountaineering, from the emergence of professional guides, winter mountaineering, rock and guideless climbing, to the present technique which draws upon a wide range of scientific resources, may be traced in the *Alpine Journal*, founded in 1863. As the sub-title, "A record of mountain adventure and scientific observations" indicates, the volumes deal not only with the achievements of climbers, but also with mountain exploration throughout the world.

Mountain exploration has as its object the elucidation of the topography of a particular mountain region and the recording of scientific data relating to it. Climbing, of course, is not excluded, but it does not constitute the sole objective. Though the

Alpine Club has at times tended to concentrate on mountaineering pure and simple, many of its members have been notable exponents of mountain exploration in this sense, and it is here that the interests of the Club and the Society most nearly coincide. The Himalaya in particular have offered great scope for mountain exploration, from the pioneering expeditions of the 'nineties onwards. Shipton's expedition to the Shaksgam valley in 1937 is a more recent example. In the same way, the Canadian Rockies offered similar opportunities in the early years of this century. Having such interests in common, it is not surprising that the Alpine Club and the R.G.S. should have worked together in the past, or that members of the Club should have been prominent in the history of the Society. Here it is possible only to recall briefly some of those who were distinguished as members of both bodies. The first President of the Alpine Club, John Ball, a scientific observer of mountains and the author of the well-known 'Alpine guides,' was for four years Foreign Secretary of the Society. Another early member, Francis Galton, F.R.S., a scientist of distinction in many fields, was a Gold Medallist of the Royal Geographical Society, Honorary Secretary for several years, and one who worked hard to improve the status of geography. As would be expected, it is the mountain explorers who form the main link between the Club and the Society. Edward Whymper was an early member of the Alpine Club, becoming a Vice-President in 1872, and was distinguished for his ascents in the Alps between 1861 and 1865, which culminated in the tragic first ascent of the Matterhorn. He then turned to other regions and eventually established his reputation as a mountain explorer by his expedition to the Andes of Ecuador in 1880. Besides several first ascents, including Chimborazo, he made a reconnaissance map which fixed the position of the principal peaks and observed the physiological effects of high altitudes. For the geographical data resulting from this expedition, he received the Patron's Medal of the Society in 1892.

Some years later the Andes attracted Martin Conway (Lord Conway of Allington), who climbed Aconcagua in 1898. Conway, with a long list of achievements to his name, including his expeditions to the Karakoram in 1892 when he explored the Hispar and Biafo glaciers and to Spitsbergen in 1894 with E. J. Garwood, was certainly a mountain explorer. A President of the Alpine Club, he was also a Gold Medallist and Vice-President of the R.G.S. Similarly, another President of the Alpine Club, Dr. T. G. Longstaff, with a distinguished record particularly in the Himalaya, has been an Honorary Secretary and Vice-President of the Society, and a recipient of the Founder's Medal in 1928. In this connection, mention may be made of Sir Halford Mackinder who secured for himself a place in mountaineering history by his ascent of Mount Kenya in 1899, undertaken to prove that an academic geographer could also be an explorer. His work for the revival of geography in Britain gives him a foremost place in the annals of the Royal Geographical Society.

Of all the mountain explorers, however, D. W. Freshfield was most prominent in the affairs of the R.G.S. In the first place, he was the only man to have been President both of the Club and the Society. Freshfield, who ascended Mont Blanc as a boy, was exploring the central Caucasus as early as 1868 when he climbed Kazbek for the first time, and he returned to them later. His exploratory work also included his Himalayan expedition, when he made the first circuit of Kangchenjunga (1899) in the company of Professor Garwood who mapped the massif, and an attempt on Ruwenzori with A. L. Mumm (1905) which was defeated by bad weather. Freshfield also had a part in the initiation of the Mount Everest expeditions. As Honorary Secretary and President of the Society his activities were varied and important, from the reshaping of its periodical publication, the improvement of the lectures, and his advocacy of the value of geography in education, to his guidance of the Society during the years of his presidency, 1914–17.

As the exploration of the Himalaya progressed and greater altitudes were attained, it was natural that the prospects of reaching and climbing Mount Everest should be examined. C. G. Bruce had suggested an attempt to Younghusband in 1893, and in

1899 Freshfield discussed the problem with Lord Curzon. Six years later Curzon came near to obtaining the consent of the Nepalese government for the entry of an expedition. Longstaff had hoped to mark the jubilee of the Alpine Club in 1907 with an attempt on Mount Everest but political difficulties continued. At this Jubilee dinner, Freshfield made a remarkable forecast in this respect: "Will the company which dines here fifty years hence include the conqueror of Mount Everest? Why not? We have raised what I may call the 'man-level' from 16,000 to 24,000 feet. There only remains 5000 more to be overcome."

In 1913 when the prospects of entering Tibet were brighter, C. G. Rawling was planning an expedition and J. B. L. Noel made a reconnaissance of the eastern approaches to the mountain. After the war, in 1919, Noel described this journey to the Society, and, in the discussion which followed, J. P. Farrar, President of the Alpine Club, gave his opinion that an attempt to climb Mount Everest was practicable and pledged the Club's support. Sir Francis Younghusband, stimulated by Farrar's remarks, advocated an expedition supported by the Society and the Club. In 1921, during Younghusband's presidency of the Society, permission was eventually obtained from the Dalai Lama, and a joint Mount Everest Committee was formed with representatives of the Society and the Club. To the appeal for funds the main response came from members of the Club. A reconnaissance was planned for that year, with an assault on the mountain in 1922. It is unnecessary to detail the course of these and the subsequent expeditions prior to 1939, for which the Mount Everest Committee of the R.G.S. and the Alpine Club was responsible. The course of events can be followed in the detailed official narratives published after each expedition. These expeditions, it may be noted, are good examples of mountain exploration. The first large-scale map of the area was surveyed by Major E. O. Wheeler, Survey of India, who accompanied the 1921 expedition, and all subsequent maps owe something to his work. Apart from the achievements of the climbers, considerable additions to knowledge of the geography, geology and natural history of the mountain and the surrounding area, and also of the physiological effects of high altitudes, resulted from the observations of various members; though in later years this work was to some extent restricted to avoid offending Tibetan susceptibilities. In the intervals between the expeditions the Committee acted as a repository of the experience of earlier expeditions and kept abreast of technical developments.

For some time after the 1939–45 war, the prospects for expeditions to Mount Everest were not bright. Tibet was closed by the Chinese, and entry into Nepal was still barred. There were however many plans being discussed for expeditions to other parts of the Himalaya which could best be dealt with by one committee. Accordingly, the Mount Everest Committee was re-formed as the "Joint Himalayan Committee of the Royal Geographical Society and the Alpine Club." Nepal then began to relax its policy of exclusion, and in 1951 the Joint Committee was able to send out an expedition under Eric Shipton which successfully reconnoitred the southern approaches to Mount Everest.

For the assault on the summit in 1953, the Joint Committee appointed Colonel John Hunt leader, and decided, in order to make as sure of success as possible, that all the resources of modern research in oxygen should be applied to overcoming the deterioration of mental and physical powers at great altitudes. This preliminary work on oxygen, resulting in the designing of "closed circuit" and "open circuit" apparatus, was a major factor in the success of the expedition. Since everything was subordinated to the ascent of the mountain, no scientific work was carried out on this expedition, with the exception of physiological research which was the logical extension of the preliminary work on oxygen. This was made possible, on the initiative of the R.G.S., by a generous grant from the Royal Society, and the support of the Medical Research Council. The first account of the ascent was given to members of the Alpine Club and Fellows of the Society at a joint meeting in the Royal Festival Hall in September 1953, and H.M. The Queen was present at a later meeting in November.

It was decided that the profits of the expedition—royalties from the book, film and photographs, and fees from lectures in many countries—should be placed in a trust fund. To administer this, and to take over the other functions of the Himalayan Committee, the Mount Everest Foundation was established in 1955. The office of Chairman is held by members of the Club and Fellows of the Society in rotation, and the Committee of Management is composed of an equal number of representatives of the two bodies, acting as Trustees. Sir James Wordie, a past President of the Society and one of its Gold Medallists, was the first Chairman of the Foundation. He was succeeded in 1956 by Sir John Hunt, nominated by the Alpine Club, who in turn was followed by Sir James Marshall-Cornwall, President, R.G.S. The purpose of the Trust is to encourage and support exploration and research of all types in mountain regions, and not mountaineering expeditions only. Considerable grants have been made to numerous expeditions, including the successful British Kangchenjunga expedition of 1955, and the Trans-Antarctic Expedition led by Dr. V. E. Fuchs. For the year 1956–7 the grants allocated in this way by the Foundation totalled £26,145. Thus, at the outset of the Alpine Club's second century, the Club and the Society are working together to extend geographical knowledge. G. R. CRONE

TRANS-ANTARCTIC EXPEDITION

A recent dispatch from Dr. Vivian Fuchs summarized the activities of the expedition since the arrival of the *Magga Dan* in January 1957. It is now known from air reconnaissance that the Filchner ice shelf extends 200 miles south from Shackleton to the western foot of a range lying beyond the newly discovered Theron mountains; this range has been named after Sir Ernest Shackleton. The great glacier between the Theron mountains and Shackleton range is 25 to 30 miles wide and over 90 miles long, and may be considered one of the largest in the world; it has been named the Slessor glacier after Marshal of the Royal Air Force Sir John Slessor, Chairman of the Expedition Committee. Shackleton range, like the Theron mountains, lies roughly east and west, and south of the range is another great glacier flanked to the south again by the rocky outcrops which are known to the expedition as the "Whichaway Nunataks." Thirty miles beyond lies the depot named South Ice. There is no easy fairway to South Ice, for the route lies across the grain of the country, and what is on the other side of the station is unknown. It is hoped, however, that conditions may become easier on the higher Polar plateau.

The latest news from the expedition is that the Trans-Polar party left Shackleton for South Ice on November 24 on the first stage of their 2100-mile journey across the continent by way of the United States Base at the South Pole, beyond which they will meet Sir Edmund Hillary and his party coming from Scott Base on the Ross Sea.

IGU NEWSLETTER

The latest number of the IGU *Newsletter* (Vol. 7, No. 2, 1957) contains some useful lists, following up the complete list of IGU Commissions and their members contained in the last issue. The current issue gives details of the adhering organizations and national committees in each member country—a total of forty-eight entries. Also to be found in this *Newsletter* are bibliographies of publications of the Makerere Symposium (September 1955) and of the 18th Geographical Congress held at Rio de Janeiro in 1956. Attention of members is drawn to the fact that all publications, a list of which will be published in the next *Newsletter*, will in future be available from Geographical Publications Ltd., Ebbingford Manor, Bude, Cornwall.

THE MEETING OF THE BRITISH ASSOCIATION, 1957

The capital city of Dublin gave a warm and gracious welcome to the 119th annual meeting of the British Association, held between 4 and 11 September 1957. Section E enjoyed the hospitality of Trinity College, and members found delight in inspecting the fine buildings of the college and the city.

The programme of the Section had been arranged to enable members to study the geography of Ireland from papers and from an extensive programme of field excursions. Opportunities had been taken to include papers reporting the results of recent research work on many aspects of the geography of the country, many of them by Irish geographers. In accordance with custom, the meetings on the first morning were devoted to a study of the local region. Mr. J. P. Haughton gave a clear account of the growth of Dublin and delimited the present functional areas of the city, while Dr. A. Farrington contributed a lively analysis of the geomorphology of the Dublin region. Mr. Haughton conducted an afternoon excursion on foot through the city to illustrate his paper and other parties were led by Dr. J. H. Andrews and Mr. T. Jones-Hughes on a wider tour of the city and its neighbourhood.

A crowded audience assembled on Friday morning for Professor D. L. Linton's presidential address on "The Everlasting Hills." The President demonstrated that, by the geological time-scale, the carving and even the destruction of hills and mountain ranges is a relatively rapid process. He examined the evidence available for the study and examination of the origins of the land forms of upland areas and drew attention to the need for full and critical examination of all the available evidence. His address, which has been printed in *The Advancement of Science* (vol. 14, No. 54), attracted considerable attention and, without doubt, forms an important contribution to geomorphological thought. It was preceded by a paper from Dr. Monica Cole reporting the results of her recent field work in Brazil in a paper entitled "The Savannas of Brazil." This paper, too, was warmly received not least on account of the large number of colour slides with which it was illustrated.

During the week-end excursions were made into the Irish countryside. On Saturday, three parties studied eastern County Wicklow and the coastal towns (Dr. J. H. Andrews), the Boyne valley (Mr. Haughton) and the Tullamore district of the Central Lowland (Mr. T. W. Freeman). The Sunday excursions included studies of the East Wicklow hill country (Mr. Freeman), Trim and southern County Meath (Mr. G. L. Davies), the Dublin Mountains (Mr. Jones-Hughes) and the Lake Blessington district (Dr. Farrington).

The four papers read on Monday morning illustrated various approaches to the study of population geography, special reference being made to Ireland. Mr. Freeman's general survey of "Population decline and landscape change in rural Ireland since 1845" was followed by a more detailed analysis of "The pioneer fringe in Ireland after the great famine" by Mr. Stuart H. Cousens. Mr. Richard Lawton discussed the pattern of "Irish immigration to England and Wales in the mid-19th century," while Dr. Joy Tivy and Dr. J. R. Caird offered an appraisal of "South Uist: a Scottish congested district" and drew enlightening comparisons with conditions in Irish "congested districts."

The papers read on Monday afternoon presented the results of recent work on various aspects of the historical geography of Ireland. Dr. J. H. Andrews was concerned with the geographical value of Irish surveys and descriptions of the period 1654–84, with special reference to Co. Wexford, Mr. T. Jones-Hughes with the rural economy and settlement pattern of East Leinster at the time of the great famine, while Mr. R. H. Buchanan, in a stimulating paper, discussed "Rural change in an Irish townland since 1890," showing that changes in settlement and farm holdings reflect changes in social structure and agricultural economy.

Tuesday morning's programme included three contributions on the geomorphology of Ireland. The paper by Mr. G. L. Davies on "Irish erosion surfaces—a statistical analysis" aroused much discussion. Mr. J. B. Whittow offered a paper (read in his absence by Professor A. Austin Miller) on "The structure of the southern Irish Sea area" and Mr. N. Stephens examined "The evolution of the coast-line of north-east Ireland." The morning session concluded with a contribution from Mr. V. Bruce Proudfoot on "Peat and peat-soils in Northern Ireland." During the afternoon the Section visited the headquarters of the Ordnance Survey in Phoenix Park and received

a warm welcome from the Assistant Director, Colonel Niall MacNeill, and his staff. Colonel MacNeill was also responsible for the arrangement of an exhibition in the Section meeting-rooms illustrating the history and development of Irish maps, a much appreciated feature of the meeting.

The proceedings of Section E concluded on Wednesday morning with papers by Mr. Peter Haggett on "Industrial concentration versus regional stability," a study of conflicting trends in the current industrial development of Portugal, and by Mr. R. Mansell Prothero on the methods employed in the compilation of the 1 : 1,000,000 maps of population in northern Nigeria.

An unusual feature of this meeting was the long field excursion organized jointly by Section E and the Institute of British Geographers which took place on the five days following the meeting. A study was made of both the physical and human aspects of the landscape of West Cork and Kerry under the direction of Dr. Farrington and Mr. Haughton. The party of thirty-four members was accommodated for two nights at Cork and for two nights at Killarney under excellent arrangements made by Mr. G. L. Davies.

No report of the meeting as a whole would be complete without a mention of the generous hospitality provided for the Association by its Irish hosts. Members were warmly entertained by His Excellency the President of Ireland, by the Government of the Republic of Ireland and by a number of Dublin societies and concerns. A symphony concert given in the Gaiety Theatre by the Radio Eireann Symphony Orchestra was also greatly appreciated. All members received a copy of the scientific survey, 'A view of Ireland.'

Section E met for dinner on Monday evening in the Royal St. George Yacht Club, Dun Laoghaire, and welcomed as its guest Professor Gunnar Hoppe of Stockholm. In the course of his speech after the dinner the President of the Section paid a warm tribute to the work of the local organizers, Dr. Farrington, Mr. Haughton and, notably, Mr. G. L. Davies, the local secretary, whose arrangements for the convenience of members were flawless.

There can be no doubt that members of the Section left Dublin with a fuller awareness of the conditions and problems of Irish life and with a considerable appreciation of the work which their geographical colleagues in the Republic of Ireland are achieving despite their limited numbers and resources. It was the generally expressed hope that the meetings of Section E had stimulated interest in geography in Ireland and strengthened the work of Mr. Haughton and his colleagues.

The meeting in 1958 will be held in Glasgow from August 27 to September 3, when Section E will meet under the Presidency of Professor E. Estyn Evans. Offers of papers are invited and should be made immediately to the Recorder, Dr. M. J. Wise, at the London School of Economics and Political Science, Houghton St., Aldwych, London, W.C.2. M. J. WISE

SUDAN CENSUS

The report on the 1953 Pilot Population Census and the first two Interim Reports on the First Population Census 1955–6, with an introductory Supplement, have been received in the Society's Library. The decision to hold a census in Sudan was taken in the time of the Condominium, before the advent of self-government, and the "Pilot Census" to test out the applicability of selected techniques was completed in 1953. It is greatly to the credit of the Sudanese Government that with all the other preoccupations of newly won independence they were able to carry on with the original scheme and to complete it. The successful application of scientific sampling techniques to a census of Sudan is remarkable. The area of the country is little short of 1 million square miles, and the population was thought, before the census, to be of the order of 9 million. (This has now been shown to be some 20 per cent. less than the true figure.)

Although Sudan only occupies a small part of Africa, it has often been regarded as

a microcosm of the continent. It stretches from a rainless belt in the north to the edge of the tropical rain forest in the south-west, and contains all the ecological patterns of life to be found elsewhere in tropical Africa between these two extremes. It also has examples along the Blue, White and Main Niles, of every kind of African riverain society. Even the semi-temperate climate of the Kenya highlands and Abyssinia has a counterpart in the mountains of Darfur and the Imatong mountains of Equatoria.

When the results of the census are fully analysed and published they should provide the framework within which to devise programmes of future developments. This is rightly regarded by the Government as the primary function of the census. But they will also be in themselves a most valuable demographic survey, available for the first time, of Sudan and its inhabitants. Owing to the great variety of peoples and climates in Sudan, the final analysis of the census, with its appendices, should prove of very great interest to other African territories which have not yet conducted such elaborate investigations of their own people.

The empirical methods of guessing at population figures employed in the days of the Condominium Government probably served their purpose as well as those of any other African administration, but the superiority of scientific analytical techniques is revealed even in these early volumes published by the Ministry of Social Affairs. So much detailed information is being provided which was never available before that it is ungrateful to criticize, but it is misleading, to take an example at random, to find in the analysis of "tribal or nationality groups" of Kutum East Census Area, which is in north-eastern Darfur, that the great bulk of the inhabitants are classified as "tribes of western Darfur." It is not easy to find out how these categories are defined, and the introductory parts are not very helpful. It may, however, very well be intended that more help should be given in the final report to make it easy to cope with the mass of interesting material which has been brought to light.

It is of interest that the official name of the new state is given as "The Republic of Sudan" in English, and that the old familiar definite article in "The Sudan" has been dropped from the English version, though not of course from the Arabic: one is left wondering whether this is not a pity.

W. P. G. THOMSON

THE CONFERENCE OF GERMAN GEOGRAPHERS AT WÜRZBURG

The thirty-first Deutsche Geographentag was held from July 29 to August 5 of this year. Over 800 geographers from universities, schools and other walks of life gathered together, and a report of the conference, unavoidably held over owing to lack of space, will appear in the *Journal* for March 1958. The fifty or so papers are to be published in the series 'Verhandlungen des Deutschen Geographentages,' Band 31, due to appear in 1959.

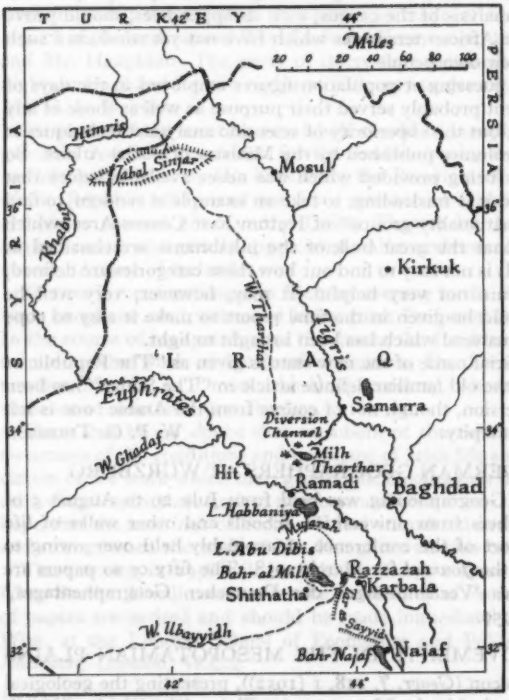
RECENT TECTONIC MOVEMENTS IN THE MESOPOTAMIAN PLAINS

The paper by Lees and Falcon (*Geogr. J.* 118, 1 (1952)), presenting the geological approach to matters archaeological in the Mesopotamian Plains, has stimulated much discussion (see articles by Ionides, Smith, Lees and Falcon, *Geogr. J.* 120, 3 (1954), Falcon in *Geogr. J.* 122, 3 (1956)), and there is every indication of some hard thinking on the part of both professions. Lees and Falcon demonstrated recent instability within the Plains, a view which meets with geological approval (personally the writer has spoken to only one geologist who is in disagreement). Field activities by the author in the Tharthar–Habbaniya–Abu Dibis area in the vicinity of the Euphrates are pertinent to the topic. Informative talks with C. Voûte, consulting geologist, have proved valuable, though the writer alone takes responsibility for views expressed here.

(1) The volume of the present Abu Dibis lake approximates to that of the Palaeolithic lake, which latter seems to have been supplied with water by the Wadi Ubaid. Sedimentation and evaporation of the Palaeolithic lake, Abu Dibis, caused it to shrink in size to that of the Bahr al Milh. Old lake terraces occur at about present

water level which varies from 27 metres to 28 metres above sea level. However, some 15 kilometres north-north-west of Shithatha and about ½ kilometre west of the lake, outlier remnants of sandy clays, gravels and pebbles, found as typical beach deposits along the present shores, are now occurring as high as 7 metres above the lake level. The sporadic and often deeply denuded nature of these beach outliers renders correlations far from simple, but traced intermittently southwards we find the old shoreline descending to an elevation of about 1·5 metres above present lake level just west-south-west of Shithatha, testifying to tilting or warping.

(2) Before the Samarra barrage and diversion channel were put into operation last year, the Wadi Tharthar entered the Milh Tharthar at sea level elevation. South of the Milh the land rises to 53 metres before descending more abruptly to mean levels of 45–49 metres on the Euphrates at Ramadi, *i.e.* there is a long, gentle, northern slope and a short, steep, southern slope. Augering in this region has disclosed an ancient valley trending south-south-west from Milh Tharthar to meet the Euphrates some 2 kilometres upstream from Ramadi. This old channel slopes in the same directions as the surface, but the depth of fluviatile deposits increases southwards, from 7 metres to 25 metres. We would conclude therefore that originally the drainage was southwards from Tharthar towards the modern Euphrates.



(3) Between lakes Habbaniya and Abu Dibis lies the Mujarah depression, which likewise indicates an old channel connecting these bodies of water. Between the Euphrates and Habbaniya lake the land is lower than flood levels of the river, and via the depression water drained southwards.

(4) South of Abu Dibis extends a long, dry valley, following for much of its route the base of a prominent cliff varying in height from 30 metres to 60 metres, called the Tar as Sayyid. This dry valley slopes upwards towards the south from an elevation of 31 metres just south of Abu Dibis to an elevation of 53 metres, then slopes down southwards–south-eastwards to a mean level of 46 metres at the shallow, brackish Bahr Najaf, some 25 metres higher than the mean level of the Euphrates lying 15 kilometres to the east. This valley broadens as much as 1 kilometre, and typical fluviatile deposits reach a depth of at least 15 metres. There can be little doubt that this dry valley was once the course of a major river which probably reached the modern Euphrates valley east of Najaf.

(5) As a result of bore-hole investigations made for the proposed Razzazah dike

at the south-east end of Abu Dibis, Voûte located an old, winding, steep channel underlying the present Razzazah dry valley. This ancient outlet of the Palaeolithic Abu Dibis now has a sedimentary fill averaging at least 10 metres in thickness. Within the upper 5 metres of fluviatile gravels, sands, silts and clays of the old channel, the molluscan fauna shows an increase of freshwater specimens towards the eastern end of the outlet, and conversely, an increase in brackish-salt water species in the direction of the lake. The distribution of the fauna and sedimentary facies along this old channel are indicative of a freshwater river flowing westwards from the Euphrates into the brackish and salt water environment of the lake. Palaeolithic lake waters previously drained eastwards along this channel towards the Euphrates, but a reversal in drainage direction caused Euphrates waters to drain westwards into the lake. In a bore-hole drilled to a depth of 26·8 metres at a locality 1·5 kilometres down the Razzazah valley from the edge of the lake, a flintstone artifact of possible early Palaeolithic age, was found at a depth of 4·6 metres, suggesting that the valley was silted up after the formation of the Palaeolithic lake. (A preliminary attempt at drawing structural contours for two N.W.–S.E. striking rock units, presumably of Upper Fars (U. Miocene) and late Pliocene age, in the Razazazh region shows a distinct inflexion of the contours across this valley.)

(6) Within the old Tar as Sayyid channel and that connecting the Milh Tharthar with the Euphrates, common freshwater mollusca such as *Unio sp.*, *Linnae sp.*, etc., have been found in cores, indicating a relatively fast-flowing river. On the other hand, brackish and salt water molluscan forms, *e.g. Cerithium sp.*, *Cardium sp.*, etc., have been collected in the immediate vicinity of Milh Tharthar, Habbaniya and Abu Dibis lakes, suggesting standing bodies of brackish-saline water existing under warm climatic conditions.

(7) The Sinjar anticlinal structure, in its eastern extension, effectively forms a divide for tributaries flowing north to the Himris river and south to the Wadi Tharthar. The uplift causing this structure continued into the Pleistocene. The abrupt westward deflexion of the Himris flowing parallel north of Jabal Sinjar has every appearance of being a recent drainage adjustment, caused by the rise of this anticline.

It would appear that a series of east–west upwarps (or fault movements?) are interfering with a generally southerly flow of the drainage. In the north there is the Sinjar structure which has caused an earlier "geological" drainage adjustment; between the Milh Tharthar and the Euphrates, recent vertical movements have blocked off the southward drainage of the Tharthar into the modern Euphrates near Ramadi; between the Habbaniya and Abu Dibis lakes higher land intervenes, with only the Mujarah depression connecting; east of Abu Dibis, the old Razzazah channel indicates reversal of flow of waters; the Tar as Sayyid dry valley shows up-arching in its central part, with slopes to north and south. The geological recency of all these "interruptions" is obvious.

It is concluded that originally a major drainage course flowed from the area west of Mosul via the Tharthar–Milh Tharthar–Habbaniya–Mujarah–Abu Dibis–Tar as Sayyid route to the vicinity of Najaf. Interruptions of the drainage, as well as raised lake beaches, indicate recent tectonic vertical movements within the generally overall subsiding Delta Plains.

RAOUL C. MITCHELL

BOTANICAL SOCIETY OF THE BRITISH ISLES

At the Royal Society's Conversazione in May 1957 the Botanical Society of the British Isles had an exhibit illustrating its Distribution Maps Scheme. The Society is recording the occurrences of wild plants in Great Britain and Ireland, using a punched card system. The interest of the scheme for geographers is in the mechanical production of distribution maps from the data on the cards. The information punched on a set of cards relating to a particular plant includes the National Grid references of its reported occurrences. When these cards are fed into it, the tabulator

prints, on a gridded map, symbols in the 10-kilometre grid squares from which the plant has been reported. If desired, a more detailed grid reference could be used. In this scheme, the resulting analysis is qualitative since it merely records that the plant has been observed in certain areas. The tabulator can transfer the grid references on to the base map as symbols at the rate of about one hundred per minute. When the map is completed, it serves both as a record and as a guide to further research. It is estimated that between 1 and 1½ million records, each on a separate punched card, will be accumulated before the final maps are drawn for publication in a single atlas, containing about 2000 separate maps. Maps already completed show previously unsuspected distributions and clarify others. This use of the tabulating machine for mapping has been developed by Powers-Samas. An account of the scheme is given by S. M. Walters in the *Proceedings* of the Botanical Society 1, 2 (1954) 121.

GEOGRAPHICAL INSTITUTE AT KIEL

The Library has recently received for review several monographs in the series 'Schriften des Geographischen Instituts der Universität Kiel.' Gerhard Rust examines (vol. 15, pt. 4) the production of fish, mainly carp, in artificial ponds and tanks in Schleswig-Holstein. Established at an early date in association with farming, the industry now has an output, varying with the weather, of 100 to 250 tons a year. Wilhelm Lauer's study of the vegetation, use, and agricultural potential of El Salvador (vol. 16, pt. 1) is based on a year's field work throughout the country. He reconstructs the natural vegetation and colonial land use for comparison with present conditions, particularly the distribution of population. El Salvador faces difficult problems arising from a rapidly growing population and extreme fragmentation of holdings. Much of the farmland is on slopes too steep to be ploughed and is subject to a "robber economy." Given a rational plan for agriculture, however, there would be sufficient good land to support the increase in population. A study by Mohammed Ismail Siddiqi deals with the fishermen's settlements on the west Pakistan coast (vol. 16, pt. 2). Some 12,000 persons in twenty-eight settlements are dependent upon these fisheries. Most of the fish is dried and preserved; only some 2 per cent. is dispatched fresh to inland markets. The author discusses the revolution required in technique and marketing arrangements if the position of the fishing folk is to be improved. The latest issue (vol. 16, pt. 3) is a detailed study by Helmut Blume of the cultural landscape of the Mississippi delta in colonial times with reference to the German settlements on the river above New Orleans. Established in the mid-eighteenth century, the settlers at first combined the cultivation of indigo with rice and maize, but by the end of the century, sugar plantations and slave labour were being introduced. The settlers, never very numerous, were eventually absorbed by the French population, but not before they had left their mark on the river bank villages.

AGRICULTURE IN PAKISTAN

A report has been issued by the Oxford and Cambridge Far Eastern Expedition 1955/56 on "The agricultural development of the Thal Desert"; it is by P. Murphy and H. Nott, is dated 1957, and runs to 106 typewritten pages with accompanying maps. In it, two members of the Oxford and Cambridge Expedition to the Far East give an account of what they saw and learnt of the Thal during the course of their overland journey to Singapore and back in 1955/56. It is a comprehensive account, well documented, and shows a sound approach to what is perhaps one of the most important of all the Pakistan development schemes. The authors describe the natural environment and the social and economic background to the colonization of this hitherto thinly peopled semi-arid tract between the Indus and the Jhelum. They have been anxious, too, to see whether the scheme is agriculturally and economically sound, and they provide much statistical information concerning the "economics" of a 15-acre holding. Indeed, they have done well to provide a set of accounts for what is,

after all, a peasant economy, and have succeeded in showing that these very small units are "economic." The proof is, however, not conclusive and there are many who will continue to question whether such small holdings are sound; as the authors themselves note, there is little margin of safety as far as water supplies are concerned, and in any case, rates of population growth and the laws of inheritance are bound to raise problems in the very near future.

The authors also attempt a comparison between the Thal and two other areas; Lyallpur (Punjab) and Ben Amir (Morocco). They show on the basis of comparative costs, etc., that while the Thal scheme is not as profitable as the other two, the Thal Development Authority has managed to do a great deal with a less promising environment and a poorer water supply. The authors have tried, too, to indicate the comprehensive nature of the T.D.A.'s work, which covers housing, roads, afforestation, industry etc., as well as management of the water taken from the main canals. It is perhaps in trying to cover all these aspects that the authors have not quite done justice to their own work on the Thal. They spent some time studying two *Chaks*, or colonies, and could therefore have devoted more space in this report to their detailed findings. This report is at present only available in typescript, a copy of which is in the library of the Society. MARTYN J. WEBB

THE FORGOTTEN DESIGNER OF THE SUEZ CANAL

At a time when the Suez Canal is so much in the news, it is only fair to recall that the original plans on which its construction was based were not designed by de Lesseps but by the Austrian engineer Alois von Negrelli. To do so should in no way detract from the importance of the former whose achievement in accomplishing the actual construction remains as great as ever.

Negrelli was born on 23 January 1799, in Primiero, Trentino, then part of Austria. He entered the Austrian civil service and made his name mainly by the construction of a great number of railways in Bohemia. After 1848 he was put in charge of reconstructing the Upper Italian railways which had been destroyed in the war. In 1850 he was appointed president of the Commission for the Navigation of the Po and in 1856 Inspector General of the Austrian Railways. For two spells, between 1833–40 and 1845–8, he had also been working in Switzerland, where he built the harbour of Zürich, and during his second stay was director of the works at the Swiss Northern Railway System. In recognition of his work he was knighted by the Emperor and given the title Ritter von Moldelbe, in response to his request that his title should have a reference to his work as a railway constructor in Bohemia. During his first sojourn in Switzerland in 1838 he met Alexander von Humboldt, who directed Negrelli's attention to the ancient desire of mankind to establish a waterway between the Red Sea and the Mediterranean, a project which caught his imagination. On the occasion of the foundation of the international Société des Études pour le Canal de Suez on 20 September 1846, Negrelli was nominated to head the delegation of the States of the German Confederation and was a delegate to the Study Commission established by the Society. The preparatory work of this commission was however interrupted in 1848 by the revolutions in Middle Europe and was subsequently deadlocked by internal controversies. It was only then that Ferdinand de Lesseps entered the scene. While serving as French Vice-Consul in Cairo he had in 1833 been entrusted with the education of the heir to the throne and in 1854, after the succession of his former pupil, he secured from the Viceroy of Egypt, Said Pasha, an order for the construction of the Suez Canal. When on 30 October 1855, de Lesseps convened the constituent meeting of the new International Commission for the Suez Canal, Negrelli was the only member of the former study commission to take part. In the first session of the new Commission which opened in Paris on 23 June 1856, Negrelli attended as the representative of Austria, on whose behalf he had already participated in the commission's preceding winter trip to Egypt. The members of this session unanimously accepted Negrelli's plans regarding the layout and the sluiceless

construction of the Suez Canal. On 3 April 1857, the Viceroy of Egypt appointed Negrelli Inspector General of all projects relating to the construction of the Suez Canal, but owing to his early death on 1 October 1858, in Vienna, Negrelli was not to see the inception of operations on the Canal project or to reap the fruits of his work.

For a negligible remuneration de Lesseps induced Negrelli's widow to surrender to him the entire construction plans and documents. At the inauguration of the Suez Canal in 1869 Negrelli's name was not even mentioned (nor, incidentally, does it appear in the article on the Suez Canal in the Encyclopaedia Britannica). A law suit for compensation for the interests due on Negrelli's founders' shares and for the construction plans, which was filed by his daughter in 1890 dragged on for over two decades. Not a court decision but the peace treaty after Austria's defeat in the Great War brought it to an end. For the sake of justice the designer of the Canal, Alois von Negrelli, deserves that his name should not be forgotten.

REFERENCES

Informationen aus Österreich, No. 14 (1957), pp. 8–9.
Enciclopedia Italiana, **24** (1934), pp. 509–10.
Baratta, M., 'Luigi Negrelli e il canale di Suez.' Pavia, 1925.
Birk, A., 'Alois von Negrelli.' Wien, 1915.

KARL A. SINNHUBER

SOVIET SERIALS IN THE SOCIETY'S LIBRARY

BULLETIN (IZVESTIYA) ACADEMY OF SCIENCES OF THE U.S.S.R. GEOGRAPHICAL SERIES, 1957: No. 2 (March–April). The main achievements of the first expedition to the Antarctic ocean organised by the Academy of Sciences of the U.S.S.R., by V. G. Kort. Laws governing the absorption of heavy rainfall in forest belts, by D. L. Armand. Geological age and stratigraphic importance of the upper paleolith, by A. A. Velichko. A geographical survey of Brazil, by I. P. Gerasimov. Factors affecting the structure of German economic geography, by M. M. Zhirmunskiy. The development of the industrial resources of the Volga region in the sixth five-year plan, by K. V. Dolgopolov and E. F. Fedorova. The study of the thermo-hydrological regime on the earth's surface, by D. P. Dubinskiy. The origin of the enclosed hollows (*alass*) of central Yakut, by N. A. Bel'mina. The problem of improving the regulation of water in the rivers of the Crimean uplands, by V. A. Rutkovskaya. General economic zoning of the U.S.S.R., with special reference to the northern region, by S. L. Lutskiy. The centenary of the birth of Y. M. Shokal'skiy (two commemorative articles and the reports of two scientific sessions held in his honour, by various authors). Oceanographical research in the Chinese People's Republic, by V. G. Bogorov and A. D. Dobrovol'skiy. Recent data on the post-glacial uplift of the Baltic shield, by Y. A. Meshcheryakov and M. I. Neyshtadt. Joint researches of Chinese and Soviet geographers in the Amur basin, by V. V. Nikol'skaya and V. P. Chichagov.

BULLETIN (IZVESTIYA) ALL-UNION GEOGRAPHICAL SOCIETY OF THE U.S.S.R., Vol. 89 (1957), No. 2 (March–April). Yuliy Mikhaylovich Shokal'skiy and the Geographical Society of the U.S.S.R. (on the centenary of his birth), by E. E. Shvede. Problems of Soviet physical geography, by A. A. Grigorev. Cartography at international geographical congresses as it concerns the Geographical Society, by K. A. Salishchev. The geographical zoning of land, by K. I. Fatkin. The continents and "quarters of the globe," by N. I. Leonov. Origins of the relief of the Urals, by V. D. Libner. Dispersion and wanderings of the Samoyede tribes, by A. V. Smirnov. Errors in the interpretation of the Armenian manuscript map and in determining the period of its composition, by O. Oganesyan. Obituary of Nikifor Stephanovich Fedorov, by A. I. Fedorova and V. I. Rechkin.

NOTES

Information has been received about the NAIROBI GEOGRAPHICAL ASSOCIATION, an independent body holding meetings once a month, and organizing excursions. A circular letter is sent to members, and the address of the Honorary Secretary is P.O. Box 11375, Nairobi. The Association will be pleased to welcome geographers visiting East Africa as its guests, but would be glad to know the date of arrival and plans of visitors in advance.

* * *

Volume I of a bibliography of Portuguese geology has been presented to the Library by the author, Dr. Luis de Menezes Acciaiuoli. Published in Lisbon under the auspices of the Director General of Mines and Geological Services, the GEOLOGIA DE PORTUGAL: ENSAIO BIBLIOGRAFICO marks the centenary of the founding of the Geological Services of Portugal. A preface in Portuguese and in French traces the history of these services from their first beginnings in 1736, to the inception of the geological services as the "Comissão Geólogica de Reino" in 1857, and from then until the institution in 1918 of the modern "Serviços Geológicos." Volume I consists of three parts, covering crystallography, geology pure and applied, mineralogy, petrography and stratigraphy; and also anthropology, archaeology and prehistory. Volume II will include geophysics, tectonics, and seismicity. References to Portuguese overseas territories are included.

* * *

An annotated catalogue of forty rare maps in the Map section of the Museu Itamaraty, a section of the Ministry of Foreign Affairs, Rio de Janeiro, has been compiled by the curator, D. Isa Adonias ('As peças raras da Mapoteca do Ministério das relações exteriores'). The maps, manuscript and engraved, relate mainly to Brazil and adjacent areas. The oldest is a MS. world map by Jeronimo Marini, Venice, 1512, said to be the first to use the name Brazil in that form. Some important engraved Dutch maps of the seventeenth century are also included. The collection was founded about a century ago by Baron Duarte da Ponta Ribeiro and was augmented by Baron do Rio Branco. Considerable use has been made of the maps in negotiations relating to the frontiers of Brazil. Plans of Rio de Janeiro and other cities are included, and there are a number of good reproductions.

* * *

OBITUARY

LEO BAGROW

Leo Bagrow, who was widely recognized as an authority on early cartography, died at The Hague on 9 August 1957 at the age of seventy-six. His special subject was the early maps of Russia and the Far East, but his interests were by no means so restricted. By his work as editor of *Imago Mundi* he did much to stimulate an interest in, and to promote the study of, the history of maps.

Born at Veretye in the Government of Perm, he was educated at St. Petersburg, graduating from the University and the Archaeological Institute in 1903. He then entered the Russian Imperial Navy, and was trained as a navigator. As an officer of the Hydrographical Department, he took part in surveys of the Caspian and the Gulf of Finland, and led an expedition to the Kara Sea for the erection of a wireless station. Later in the Far East, he worked in Kamchatka and twice visited Japan. Bagrow's lifelong enthusiasm for cartography was therefore supported by training and practical experience, and his journeys gave opportunities to build up his own map collection.

During the First World War, he was at naval headquarters in St. Petersburg, and was also professor of history and geography at the Institute of Geography and of navigation at the Technical School. In 1918 he emigrated with his wife to Berlin leaving a valuable map collection behind. In the next twenty years he travelled

extensively on business in many parts of the world, continuing his cartographical work in his spare time.

By 1917, Bagrow had published numerous papers on early maps of the Black Sea, Siberia and Asiatic Russia, and monographs on the history of ancient geography and on the literature of the history of cartography. These were all in Russian; his first work to receive wider recognition in western Europe was his bio-bibliographical study of the sixteenth-century cartographers who contributed to the "Theatrum" of Abraham Ortelius, published as supplements to *Petermann's Mitteilungen* in 1928 and 1930. This is a valuable reference work based on a detailed knowledge of European map collections and the relevant literature. He also began a series of map reproductions, "Anecdota cartographica," and was working on parts 5 and 6 at the time of his death. Mention should also be made of his essay on the origin of Ptolemy's "Geographia" (*Geogr. Annaler, Stockholm*, 1945), in which he argued that this work, as it now stands, was put together in the thirteenth century, and of his "Geschichte der Kartographie," 1951, a general account of the principal groups of maps down to the mid-eighteenth century with emphasis on their aesthetic and cultural aspects.

But Bagrow's principal service to the study of early maps was undoubtedly the foundation of *Imago Mundi: a review of early cartography*, the first volume of which appeared in Berlin in 1935. Volumes II (1937) and III (1939), for which he secured the help of Edward Lynam as co-editor, were published in London.

In 1945 Bagrow with his wife was flown from Berlin to Stockholm by the Swedish authorities, once again being obliged to abandon a valuable map collection. In Stockholm he resolutely resumed his studies and was fortunate to secure for *Imago Mundi* the financial support of the cultural trust, "Humanistiska Fonden," and, when that ceased, the patronage and support of H.M. King Gustav. Ten volumes were issued between 1947 and 1956, first at Stockholm and latterly in the Netherlands. This periodical, not least for its map reproductions and bibliographies, is indispensable for the study of early cartography and is the principal medium for publication in this field. At the time of his death, Bagrow was engaged in preparing for publication, in English, a history of Russian cartography before 1800, the result of his many years of research. His collection of early Russian maps was acquired by the Houghton Library of Harvard College in 1956.

Bagrow displayed remarkable determination in pursuing his studies in extremely difficult circumstances. Increasingly handicapped by deafness, he was a formidable figure to meet for the first time, but his friends testify to his "warm human sympathies and strong and genial humour."

G. R. CRONE

ROBERT NEAL RUDMOSE BROWN

Emeritus Professor Rudmose Brown began his career as a geographer in an era when the primary activity of geographers was exploration: in his middle life he did much to secure the recognition of the subject as a worthy academic discipline, and before he retired in 1945 some of his students had earned higher degrees and he himself had been the distinguished second president of the Institute of British Geographers, a body chiefly concerned with the publication of the fruits of geographical research. So his personal career displayed what have in fact been three distinctive and consecutive phases in the evolution of twentieth century geography in Britain.

Trained initially as a botanist in Aberdeen and Montpellier he became imbued with the geographical ideas of Patrick Geddes during the years 1900–2 when he was Assistant Professor of Geography at University College, Dundee. In 1902 his decisive opportunity came to him in the form of an invitation from W. S. Bruce to go with him on the *Scotia* as botanist and marine zoologist to the Scottish National Antarctic Expedition. In two years this expedition gave us our first valid ideas about the oceanography of the Weddell Sea and discovered the coast on which both the British Trans-Antarctic and Royal Society bases are located today. In the next twenty years nothing really displaced Bruce and the Polar Regions in Rudmose

Brown's affections. He went with Bruce to Spitsbergen no less than four times (in 1909, 1912, 1919 and 1920), and out of this long association came three of Rudmose Brown's books—his 'Spitsbergen' published in 1920, his biography of Bruce ('A naturalist at the Poles,' 1923), and his general survey 'The Polar regions' (1927). His active interest in things polar lasted into his retirement, and he presided over the Antarctic Club in 1931, and the Arctic Club in 1949. His travels, however, were not exclusively polar: he studied the pearl fisheries of the Mergui archipelago for the Indian Government in 1906, and visited Australia during the meeting of the British Association in 1914 and Canada during the Toronto meeting of 1924. Small wonder that Rudmose Brown's lectures presented geography in the world view, or that they were enlivened by first-hand experiences of life in all latitudes.

Rudmose Brown's appointment as the first lecturer in geography in the University of Sheffield in 1908 has a direct connection with the Royal Geographical Society. In November 1907 the then President of the Society, Sir Taubman Goldie, was guest of honour at a dinner given in Sheffield by the Court of Governors, and he took the occasion to urge the young university to institute teaching in the subject. His words so impressed Mr. Edgar Allen, a steel manufacturer and notable benefactor to both city and university, that Mr. Allen offered to find half the salary of a lecturer for five years. The post was advertised and filled, and in the summer of 1908 Rudmose Brown attended one of Herbertson's famous summer schools in Oxford—his only formal instruction in geography—before taking up his duties in October.

Despite this early beginning geography in Sheffield received little opportunity or encouragement till the 1920's. However in 1920–1 the Faculty of Pure Science approved courses for an Honours School, but these could not be implemented till an assistant lecturer was appointed in 1924. The first Honours degrees were given in Science in 1926 and in Arts in 1927. In 1931 the elevation of his lectureship to a chair was a fitting recognition of his scientific standing and integrity as well as of his labours for the subject. Outside the university these had included his Recordership of Section E of the British Association for six years, his Presidency of the Section at Leeds in 1927, his service to the Council of the Association from 1933/38, and of this Society from 1925/28 and in 1945–6. His book 'The principals of economic geography' (1920) served the subject in revised editions for nearly thirty years, and the volume on 'The scope of school geography' in which he collaborated with O. J. R. Howarth and J. McFarlane was an important factor in the rise of geography in schools.

Rudmose Brown's career as a geographer, based on the twin foundations of exploration and natural science, was in some ways the most complete of any in Britain in his day and age. He was not a regional geographer like Herbertson or Oglivie, or a systematist like those of us who belong to a succeeding generation. He was, to the last, a world geographer. Perhaps he was the last in this country.

DAVID L. LINTON

M. F. W. HOLLAND

In July 1957 Michael Holland died in a blizzard, with Carsten Velsboe, a young Dane, on the ice cap above Inglefield Fjord, north-west Greenland. They were engaged in the glaciological work of the International Geophysical Year and were members of the Danish expedition led by Dr. Børge Fristrup.

Holland was only twenty-nine, and in the course of a few years had become an outstanding academic and arctic geographer. His first arctic experience was in West Spitsbergen in the summer of 1948, when he led a small party from the University of Birmingham and his determined achievement in spite of considerable difficulties attracted attention. He was elected a member of the Arctic Club.

Entering St. Peter's Hall, Oxford, early in 1951, he threw himself into the many activities of college life and was a prominent member of the university mountaineering and exploration clubs. He climbed in this country and in the Alps, ski-ed, and undertook summer work in the arctic. Thus he returned to Spitsbergen with John Hartog in 1951 and accomplished the first successful geological investigation of the south

coast of North East Land. Graduating in 1953, he was a member in that year of the Oxford expedition to West Spitsbergen and so was able to follow up the geological work which he had started in North East Land in 1951. Two years' research in Oxford followed, devoted to his geological and physiographical work in Spitsbergen, and he was awarded his B.SC. Other and wider problems arose, on which he was completing a thesis for the degree of Doctor of Philosophy at the time of his death, and in the interval he had become a Tutorial Fellow at Bedford College, London.

In 1956 a climbing and glaciological expedition to the Sukkertoppen ice cap, west Greenland, was planned in Oxford and organized at Bedford College. His account of it will appear in the *Geographical Journal* and will describe, in particular, the first ascent of Mount Atter, named after an Oxford man lost in that region before the war. A year later his letters from Inglefield Fjord, where Dr. Fristrup had left him in charge of the base camp and ice cap station, speak of his happiness and confidence in his work among the beauties of sea, land and ice, and the arctic flowers, which were the breath of life to him.

K. S. SANDFORD

ADMIRAL LORD MOUNTEVANS, K.C.B., D.S.O.

Admiral Lord Mountevans, whose death at the age of seventy-five was announced in *The Times* of 22 August 1957, requires no introduction to geographers who are interested in polar exploration. His first contact with the Society was when he joined the *Morning*, the little steam yacht sent out by the R.G.S. in 1902 to the relief of Captain Scott's first (*Discovery*) Antarctic Expedition. He served his polar apprenticeship under Captain England, and as junior officers he and Gerald Dovely had many sea adventures and kept the ward-room lively under the worst circumstances. He joined Captain Scott's second expedition at an early stage and was prominent in helping to raise funds for it, especially in his native Wales. He was in command of the *Terra Nova* until she reached the Antarctic when he handed over to Lieutenant Pennell. He was perhaps not so much at home on land journeys as at sea, but he took part in the work of survey and navigation and was a member of nearly all the sledge journeys. On the journey to the Pole, he was the last to leave his leader and he made a desperate journey home with his two sledge-mates, Chief Stoker Lashly and P.O. Crean. He contracted scurvy and it was only his own pluck and the heroism of his two companions that saved his life. They pulled him on the sledge for about 100 miles and when they could go no further, Lashly stayed with the patient while Crean walked 36 miles to get help, just in time.

Evans was invalided back to New Zealand but he recovered to return again in the *Terra Nova* a year later to pick up the land party. Owing to the death of his leader Evans was in command of the expedition until England was reached.

His subsequent career as "Evans of the Broke," when he became a national figure, and later in many walks of public life as Lord Mountevans, has been fully recorded in the many tributes which news of his death called forth, not only in his own country but also in the country to which, next, he was most attached—namely Norway.

PROFESSOR HARALD ULRIK SVERDRUP

Professor Harald Ulrik Sverdrup who died in Oslo on 21 August 1957 aged sixty-eight was Director of the Norwegian Polar Institute there and a distinguished meteorologist and oceanographer. Born on 15 November 1888 in Norway, Sverdrup's early years were spent as a student in Oslo and in Leipzig, and in 1917 he was invited to take charge of the scientific work of the Norwegian Arctic Expedition in the *Maud*. Sverdrup served with Amundsen on the *Maud* from 1918 until 1925 and was editor of the scientific reports of the expedition, to which he himself contributed a large number of important papers. After the first war, for five years, he was Professor of Meteorology at the Geophysical Institute in Bergen, and in 1931 joined Sir Hubert Wilkins's submarine expedition in the Arctic ocean as chief scientist. In 1934, having returned to Bergen, he organized with Professor Hans Ahlmann the Norwegian-Swedish Expedition to north-west Spitsbergen; the start of a close personal coopera-

tion in polar and scientific work which was renewed in 1949 in the first international expedition to the Antarctic, the Norwegian-British-Swedish Antarctic Expedition, which Professor Ahlmann inspired. Between the wars and until 1948 Harald Sverdrup served as Director of the Scripps Institute of Oceanography of the University of California. It was during his service in this post that he published with Martin W. Johnson and Richard H. Fleming the now famous standard work on oceanography—'The Oceans.'

Although Harald Sverdrup did valuable work on oceanographical problems in connection with submarine operations and assault landings on beaches, he felt keenly his absence from Norway during the war, and in the post-war years when Norway was making such valiant efforts to recover from the effects of German occupation. In 1948, therefore, when he was offered the Directorship of the Norsk Polarinstitutt he accepted with alacrity, an additional inducement being the proposals put forward by Professor Hans Ahlmann, at that time Professor of Geography in Stockholm, for the Norwegian-British-Swedish Expedition which he felt, quite apart from its scientific objects, would greatly reinforce Norwegian sovereignty in the Antarctic. On his arrival in Norway, Sverdrup, with his usual energy and determination, took upon himself the very heavy burden, not only of organizing the expedition from the central office in Oslo, but also of raising the very substantial funds required for two and a half years of exploration and research in the Norwegian territory of Dronning Maud Land. It was in connection with this expedition that Sverdrup, already a Gold Medallist of the Society, had his most recent and closest associations with the R.G.S.

The whole work of planning the extensive scientific research, which was the expedition's principal objective, bore, at every stage, the marks, not only of Sverdrup's exceptionally wide scientific knowledge, but of his incisive mind and practical organizing ability. Much of the very important and successful scientific work carried out by the expedition is in no small degree due to the care and foresight with which—on Sverdrup's insistence—the scientific programmes in several fields were prepared before the expedition left. Sverdrup was also insistent—and his example might well be followed more often by polar expeditions—that full provision should be made for the publication of the scientific results. These are now coming off the press and will remain a notable memorial to Sverdrup's distinguished work in the Antarctic, as in many other fields. In the last few years, Harald Sverdrup, a man of immense industry reaching, and indeed perhaps exceeding sometimes the reasonable limits of his physical powers, was occupied not only with the Norwegian Polar Institute but also as Dean of the Science Faculty of Oslo University, and with frequent government missions to India to organize the disbursement of Norwegian funds for the promotion of Indian fishery development. Most recently he was chairman of the Norwegian National Committee for the International Geophysical Year, which added still more to the exceptionally heavy burden he was carrying. He was constantly in demand at scientific conferences of many kinds, especially those in his own field of oceanographical research.

Sverdrup's outstanding ability and distinction as an oceanographer and as a Polar scientist have been acknowledged over the years by a flow of honours and awards from many countries. As a man, he was characterized by the highest standards of integrity and great personal kindness. To these attributes must be added a deep and abiding devotion to his country of whose early history he delighted to read in the Norse Sagas of Viking days, many of which he could recite by heart. Harald Sverdrup's death deprives the world of learning of a scientist of great distinction, and deprives many in this country, in the United States, and elsewhere of a friend and colleague whose memory will always be cherished in admiration and warm affection. L. P. KIRWAN

DR. J. BURR TYRRELL

Dr. J. B. Tyrrell, whose death was notified to the Society by his son in Toronto in August last, received the Back Grant for 1896. The citation read: "To the east of

the northern part of Lake Winnipeg in Manitoba, Mr. J. B. Tyrrell carried out surveys of an exploratory nature, laying down the courses of several rivers and ascertaining the positions of a number of lakes, as well as the geological character of the country. . . ." Dr. Tyrrell was a keen and constant friend of the Society, and continually helpful in keeping us well informed on events in Canada. Dr. Tyrrell's son, Mr. T. A. C. Tyrrell, is Deputy Minister, Department of Planning and Development, Ontario.

J. P. R. WALLIS

Professor John Peter Richard Wallis, O.B.E., who died on September 18 at the age of seventy-seven, will be remembered by geographers for his distinguished service to the history of African exploration, and as the author of biographies of Charles John Anderson ('Fortune my foe') and of Thomas Baines. When the Government of Southern Rhodesia invited him, in 1943, to edit some of the documents in the Archives Department in Salisbury, he resigned his professorship in the University of Pretoria, and devoted himself to this work for the rest of his life. He was the editor of most of the volumes in the Oppenheimer Series of the Central African Archives, and was an authority on Livingstone.

CORRESPONDENCE

PATTERNED GROUND IN NIGERIA

The use of the term patterned ground to describe in a general sense linear patterns such as those noted by Mr. Grove on air photographs of Northern Nigeria[1] is liable to cause confusion in view of the widespread use of the term in recent glaciological literature.[2] Washburn[3] who has described and classified many features found under periglacial or at least, cold-climate, conditions has defined patterned ground as ". . . a group term for the more or less symmetrical forms, such as circles, polygons, nets, steps and stripes, that are characteristic of, but not necessarily confined to, mantle subject to intensive frost action."

Difficulties in terminology might be resolved, as Washburn suggested, by prefixing appropriate adjectives to the term, *e.g.* cold-climate patterned ground, which "describes most but not all patterned ground." The dune features noted by Mr. Grove would then, presumably, be described as desert-climate patterned ground, although it could be argued that such a description would be equally applicable to dissimilar patterns found under desert conditions. A more serious objection to this terminology is the definitive use of an adjective before the term patterned ground, for the adjective used must in very many cases be more specific than the evidence would justify.[4]

However, the basic difficulty in using the term without qualification arises from the occurrence within the tropics of patterned ground of cold-climate type, for example, the stone stripes of Mount Kenya described by Zeuner.[5]

V. B. PROUDFOOT

Queen's University of Belfast,

27 July 1957

[1] Grove, A. T., "Patterned Ground in Northern Nigeria." *Geogr. J.* **123** (1957), pp. 271–4.

[2] Refs. in A. L. Washburn, "Classification of Patterned Ground and review of suggested origins." *Bull. Geol. Soc. America*, **67** (1956), pp. 823–66 and J. K. Charlesworth, 'Quaternary Era' (London, 1957), p. 569.

[3] Washburn, *op. cit.*, p. 824.

[4] *Cf. e.g.* the views on dune formation cited by R. F. Flint, 'Glacial Geology and the Pleistocene Epoch' (New York and London, 1947), pp. 463–5.

[5] Zeuner, F. E., "Frost soils on Mount Kenya, and the relation of frost soils to aeolian deposits." *J. Soil Sci.* **1** (1949), pp. 20–30.

INDEX

Capitals in main heading denotes articles and papers. Italics denotes books reviewed. Short notes in single quotes

Abd al Nawab, interpreter, Nuristan journey, 457 *et seq.*
Acciaiuoli, L. de. M., author of bibliog. of Portuguese geology, 575
Adélie, Terre, Antarctic, *Emperor penguins:* J. Rivolier, tr. P. Wiles, 252; French expedn. to, 251–2; gales, 292–3, 295; *Huskies:* R. Dovers, 251–2
Admiralty, early marine surveying, 450, 452 *et seq.*
Admiralty Ids., Manus, *New lives for old:* M. Mead, 254–5
Afghanistan, Afghan Government, 457, 464; ethnogr. expedn., Society's aid to, 267; JOURNEY IN NURISTAN: W. Thesiger, 457–64
Africa, *Black magic and white medicine:* M. Vane, 542–3; *Description de l'Afrique:* J.-L. l'Africain [Leo Africanus], tr. A. Epaulard, 538–9; *Erosion surfaces in Africa: some consideration of age and origin:* F. Dixey, 249–50; *High places of Africa:* J.-C. Berrier and R. Denizet, 97
Africa, Central, *African wonderland:* J. Riddell, 250; *Zanzabuku—dangerous safari:* L. Cotlow, 250
Africa, East, *British East African transport complex:* I. S. Van Dongen, 539; *Rift system:* F. Dixey, 540–1
Africa, East, and Ethiopia, *Fountain of the sun:* D. Busk, 539
Africa, French West, R. Savigear expedn., Society's aid to, 267
Africa, North, *Fool in the desert:* B. Toy, 97
Africa, West: R. J. H. Church, 537; *Road to Timbuctoo:* J. Skolle, 97–8; 17th cent. traveller in, letter on, 423–4
African buffalo trails: J. F. Burger, 543
Africanus, Leo, *see* Leo Africanus
Aga Khan, obit. of, 421
Agriculture, *La campagne:* P. George, 111
Ailoq, Nuristani encampment, 458 *et seq.*
Akademie Verlag, Berlin, *Klima Atlas für das Gebiet der Deutschen Demokratischen Republik,* 532
Alaska, *Arctic wilderness,* R. Marshall, 104–5
Albatross Geogr. Expedn. to Solomons, 300–01
Aleutian Islands, *Birthplace of the winds:* T. Bank II, 103–4
Algeria, *Aspects et réalités de l'Algérie agricole:* ed. Institut Agricole d'Algérie, 541
Allix, A., and A. Gibert, *Géographie des textiles,* 552–3
Alpine Club, Centenary of, by G. R. Crone, 563–6; joint meeting with Society, 268
Al Umchaimin crater, western 'Iraq, 231 *et seq.*
America, North, *Black gown and red skins:* E. Kenton, 113; *North American Midwest:* J. H. Garland, 98–9; *United States and Canada:* J. Wright, 98; *Wild America:* R. T. Peterson and J. Fisher, 253
America, South, *Beyond the high savannahs:* J. Wickenden, 100; *Man alone!:* V. Norwood, 100; SOUTH AMERICAN PROSPECT; 1. SOUTH AMERICA AS FIELD FOR GEOGRAPHICAL RESEARCH: J. A. Steers, 329–35; 2. BRAZIL; A GEOGRAPHER'S VIEW: L. D. Stamp, 335–40; discussion, 341–3; *Tupari:* F. Caspar, 100
American Andes expedn., *see* Cabot
American cities in growth of nation: C. M. Green, 543–4
American Geogr. Soc., Map of Hispanic America, 330
Amundsen Glacier, Antarctic, gales, 293
Andes, British Andean expedn., 117; COMPILATION MAP OF PART OF CENTRAL: J. V. Harrison, 33–6; *see also* Colombia
Aneroids, SURVEYING ANEROIDS: THEIR USES AND LIMITATIONS: R. A. Hamilton, C. A. Biddle and B. W. Sparks, 481–98; Geomorphologist's viewpoint, 488–9; Land surveyor's viewpoint, 485–8; Meteorologist's viewpoint, 481–5; discussion, 489–98; used for investigations, Wye basin, 356
Anglo-Norwegian Frozen Ground Research Expedn., 1956, 117; *see also* Williams, P. J.
Angola, *Doctors, drums and dances:* A. Laszlo, 98
Anstruther, I., *I presume* [Biogr. of H. M. Stanley], 96–7
Antarctic, *Antarctic hazard:* W. R. Cockrill, 103; *Antarctic venture:* M. Marret, 102–3; *Australian map of Antarctica:* produced by Australian Dept. of Interior, 82–3; *Conquest of Antarctic:* N. Kemp, 252–3; gales data, 289–92; OPERATION DEEPFREEZE I: M. J. N. Foster, 1–12; *see also* Adélie, Terre
Arabie centrale, Expédition en: P. Lippens, 398
Arber, M. A., remarks on "Evolution of relief of Cam valley," 206
Arctic, *Arctic Wilderness:* R. Marshall, 104–5; gales data, 287–9; *Man the ropes:* A. Courtauld, 410
Ardener, E., *Coastal Bantu of Cameroons,* 538
Arkell, W. J., *Jurassic geology of the world,* 105
Armstrong, T. E., W. Scoresby, 1790–1857, 269–70
Arnold, G., USUN APAU PLATEAU, 167–78
Ashwell, Cam valley, 188 *et seq.*
Asia, regional and econ. geogr.: L. D. Stamp, 397–8; *Handles of chance:* N. Wollaston, 247
ASIA, SOUTH, PIONEER SETTLEMENT IN: B. H. Farmer (*title only*), 425
Asia, Southeast, 5th edn.: E. H. G. Dobby, 532–3
Athlone, Rt. Hon. Earl of, obit., 278
Atlantic and Pacific, *'Moana'* [underwater exploration]: B. Gorsky, 114
Atlases, *Times Atlas of world:* ed. J. Bartholomew, 544–5; *Faber Atlas:* ed. D. J. Sinclair, 111–13
Attenborough, D., lecture, "Search for a dragon in Indonesia," 116
Auer, V., *Wissenschaftliche Ergebnisse der finnischen Expedition nach Patagonien* 1937–38 *und der finnisch-argentinischen Expeditionen* 1947–53, 545
Aurousseau, M., *Rendering of geographical names,* 553–6
Australasia, *Ten stars south of Asia:* D. Taylor, 546–7
Australia, Bureau of Mineral Resources, 158 *et seq.*, 314; *Digger's paradise:* S. Hope, 410–11
AUSTRALIA, WESTERN, CANNING BASIN OF: M. Terry, 157–66
Austria, Geographisches Institut der Hochschule für Welthandel, 420; *Salzburg Atlas:* ed. E. Lendl and others, 243–4
Austrian expedns., *see* Peru
Avalanches, *Lawinen!:* W. Flaig, 548
Avery, B. W., *Soils of Glastonbury district of Somerset,* 522–3

AVIATION AND GEOGRAPHY: Rt. Hon. the Lord Nathan (*title only*), 136
Azema, A., *Conquest of FitzRoy*, 553
Azmir, Kurdistan, 318, 321–2, 324–5, 327

Bagrow, L., obit. by G. R. Crone, 575–6
Bailey, F. M., obit. of Sir B. J. Gould, 280–1; *No passport to Tibet*, 399
Balchin, W. G. V., remarks on "Physique of Wales," 226–7
Balmer, H., *Beiträge zur Geschichte der Erkenntnis des Erdmagnetismus*, 404–5
Banaras [urban geogr.]: R. L. Singh, 91
Band, G. C., M. H. Westmacott and J. Kempe, EXPLORATION OF HUAGARUNCHO; PERUVIAN JOURNEY, 437–48
Bank, T. (II), *Birthplace of the winds*, 103–4
Bantu, *see* Cameroons
Barnard, M., *Sydney*, 546–7
Baron Inverdale, wrecked off Masira Id., 503
Bartholomew, J., ed., *Times Atlas of world*, 544–5
Baschieri, F., *see* Roghi, G.
Bauer, P., *Siege of Nanga Parbat*, 93–5
Beagle, Darwin's voyage to Patagonia, 150
Beaglehole, J. C., Gill Memorial to, 267, 428
Beardmore Glacier, Antarctic, gales, 293
Bellingshausen Sea, gales, 290, 295
Bellona Id., Solomons, 301, 303, 304, 305
Belo Horizonte, Brazil, 338; Univ. of, 338
Bernard, J., *Black mistress*, 250
Berrier, J. C., and R. Denizet, *High places of Africa*, 97
Bertram, G. C. L., Murchison Grant to, 267, 427
Bessis, A., and others, *Le territoire des Ouled Sidi Ali Ben Aoun*, 541
Bianchi-Bandinelli, R., introd. and notes, *Tuscany*, 242
Biddle, C. A., *see* Hamilton, R. A., C. A. Biddle and B. W. Sparks
Big game hunting, *Heart of the hunter:* E. Marshall, 410
Binney, Sir G., Founder's Medal to, 267, 426; remarks at Annual Dinner, 435–6; at A.G.M., 426–7
Birch, T. W., *Map and photo reading*, 265
Birket-Smith, K., with *Galathea* Expedn. to Solomons, 302, 314
Birot, P., *Les méthodes de la morphologie*, 402–3
Bjerre, J., *Last Cannibals*, 100–1
Black, R. B., obit. of Admiral R. E. Byrd, 278–9
Blåhø mountain, solifluction terraces, 42 *et seq.*
Blacklock, K. V., Cuthbert Peek Grant to, 267, 428; remarks at A.G.M., 428
Blewitt, M., *Surveys of the seas*, 550–1
Bogotá, Geogr. Soc. at, 330
Bolívar, Pico Simón, Andes, 344–6, 351, 353
Bonasera, F., H. Desplanques, M. Fondi and A. Poeta, *La casa rurale nell' Umbria*, 89–90
Borkou-Ennedi, British expedn., Society's aid to, 267
Borneo, *Borneo people:* M. MacDonald, 244–5; *Borneo story:* R. Longhurst, 96; CAMBRIDGE EXPEDN. TO NORTH BORNEO: D. P. J. Wood and B. J. Moser (*title only*), 425; *Die Insel Borneo in Forschung und Schrifttum:* K. M. Helbig, 534
Borsig, A. von, *Tuscany*, 242
Botanical Soc. of British Isles, 571
Botting, D. L., OXFORD EXPEDN. TO SOCOTRA (*title only*), 425
Bradley, J. D., Expedn. to Solomons, 302, 305, 315; remarks on "Some geographical aspects of British Solomon Ids.," 315–16
Brathay Expl. Group, Iceland expedn., 127
Brazil, 333; SOUTH AMERICAN PROSPECT; 2. BRAZIL: A GEOGRAPHER'S VIEW: L. D. Stamp, 335–40; discussion, 341–3; *Town and country in Brazil:* M. Harris, 99–100; *see also* Geography, Economic
Brion, M., *Provence*, 242
Bristol Univ., news, 560
BRITAIN, MARINE SURVEYING IN, DURING SEVENTEENTH AND EIGHTEENTH CENTURIES: A. H. W. Robinson, 449–56; *Report on Regional planning in Britain, Netherlands and Germany* 240–1; *Roman roads in*, vol. ii: I. D. Margary, 524; *Seeing Roman Britain:* L. Cottrell, 240
British Assocn., Meeting of, in Dublin, by M. J. Wise, 566–8
British Columbia Atlas of Resources: ed. J. D. Chapman and D. B. Turner, 253–4; correction, 411; *Natural resources of:* ed. J. D. Chapman and D. B. Turner, 400–1
British Columbia and Yukon Territory, Climate of: W. G. K. Kendrew and D. Kerr, 401
British Council, guide to foreign univ. scholarships, 277
British flora, History of: H. Godwin, 259–60
British Museum (Natural History), Bradley Expedn. to Solomons, 302, 315; equipment loaned to Gough Island Expedn., 22
British National Committee for Internat. Geophysical Year, *Guide to I.G.Y.*, 514
British North Greenland Expedn., reports on gales, 288; *see also* Greenland
British tropical lands, Geographical essays on: ed. R. W. Steel and C. A. Fisher, 262–3
Brooks, L., remarks on income and expenditure at A.G.M., 430
Brown, E. H., PHYSIQUE OF WALES, 208–20; remarks on "Evolution of relief of Cam valley," 204
Brown, J. C., and A. K. Dey, *India's mineral wealth*, 245–6
Brown, Maj.-Gen. R. Ll., at Annual Meeting, Canadian Geogr. Soc., 271
Brown, R. N. R., obit. by D. L. Linton, 576–7
Bruun, A. F., and others, ed. *Galathea deep sea expedn.*, 548–9
Buhl, H., *Nanga Parbat pilgrimage*, 93–4
Buenos Aires population, 329; Univ. geogr. dept., 330
Builth, Wye valley, 360, 362 *et seq.*
Bungard, T., Wye valley diagrams, 369
Burbure, A. de, article on A. Ortelius, 418–19
Burckhardt-Sarasin, C., and H. Schwabe-Burckhardt, eds. *Scheik Ibrahim (Johann Ludwig Burckhardt)*, 248
Burger, J. F., *African buffalo trails*, 543
Burghley, Lord, copy of Norden's maps, 37
Burke, G. L., *Making of Dutch towns*, 88–9
Burma, *see* India, Pakistan and Burma
Burton, Sir R. F., Burton and Speke centenary, 413–15
Bus service centres in England and Wales, 371 *et seq.*
Busk, D., *Fountain of the sun*, 539
Bylot Id., *Spring on an Arctic island:* K. Scherman, 104
Byrd, Adm. R. E., in charge of U.S. Antarctic programme, 1; obit. by R. B. Black, 278–9; Telegram to, from Society, 115; with Operation Deepfreeze I, 1, 5
Byrd, Antarctic base, 1, 8
Byzantine empire, and ancient Negev, 179–80

Cabot, American Andes expedn., 344–5, 349, 351
Cadbury, W. A., obit. by G. R. Crone, 421–2
Cader Idris, 208–9, 211, 214, 358
Cadoux, J., and others, *One thousand metres down*, 549–50
California and Southwest: ed. C. M. Zierer, 401–2
CAM VALLEY, EVOLUTION OF RELIEF OF: B. W. Sparks, 188–207; glaciation, 196–201
Cambridge, 191 *et seq.*
Cambridge expedns., *see* Borneo; Colombia; Ethiopia; Iceland; Macedonia; Persia; Peru; Spitsbergen; Tibesti
Cambridge Univ. news, by W. V. Lewis, 560–1

Cameroons, Coastal Bantu of: E. Ardener, 538
Camoens Award, conditions for, 420–1
Campbell, Capt. V. L. A., obit. by Sir R. Priestley, 131–2
Canada, *La Vérendrye:* N. M. Crouse, 113
Canadian Geogr. Soc., Annual Meeting, 271
Canals, ancient, in Negev, 181 *et seq.*
Canning, A. W., Surveyor-General Western Australia, 157 *et seq.*
Canning Basin, Western Australia, 157 *et seq.*; geology, 161–5; native wells, 159–60; oil, 157; salt pans, 160; survey of, 160–2; transport, 160; vegetation, 159; water, 159–60
Cape Town Radio, contact with Gough Island Expedn., 28
Caracas, population, 329; Univ. geogr. dept., 330
Caribbean, biology, *Windward Road:* A. Carr, 402
Carlson, A. S., *Economic geography of industrial materials*, 262
Carr, A., *Windward road*, 402
Carrington, R., *Mermaids and mastodons*, 406
Carruthers, I., CLASSIFICATION OF SERVICE CENTRES IN ENGLAND AND WALES, 371–85
Carse, D., film "Gateway to the Antarctic," 116
Cartography, *Map and photo reading:* T. W. Birch, 265–6; *Things maps don't tell us:* Armin K. Lobeck, 265–6
Caspar, F., *Tupari*, 100
Castello Branco, A. B. L., remarks on "South American prospect," 342
Caswell, J., early marine surveying, 449
Central Africa, *see* Africa, Central
Ceylon, Pioneer peasant colonization in: B. H. Farmer, 534
Chabot, G., and others, ed, *La géographie française au milieu du XXe siècle*, 235
Chambers, R. J. H., second leader Gough Island Scientific Survey, 21 *et seq.*
Channel Ids., early marine survey of, *see* Saumarez, H. de
Chapman, J. D., and D. B. Turner, ed. *British Columbia Atlas of Resources*, 253–4; *see* correction, 411; ed., *Natural resources of British Columbia*, 400–1
Charliat, P. J., *Le temps des grands voiliers*, 113
Cheesman, E., *Things worth while*, autobiogr., 554
Chesham, 72 *et seq.*
CHILTERN HILLS, ASYMMETRICAL VALLEYS OF: C. D. Ollier and A. J. Thomasson, 71–80
China, *China's changing map:* T. Shabad, 92; Geogr. Soc. of, 558; *Land of the 500 million:* G. B. Cressey, 92; *Treasure seekers in:* O. Karlbeck, 536
Choiseul Id., Solomons, 307
Cholley, A., and others, *Carte morphologique du bassin de Paris*, 530
Church, R. J. H., Back Grant to, 267, 428; 'French school of geography,' *rev. art.*, 235–7; *West Africa*, 537
Clark, R. W., *Picture history of mountaineering*, 83–5
Clayton, K. M., remarks on "Evolution of relief of Cam valley," 204; remarks on "Physique of Wales," 223
Coates, A., *Personal and oriental*, 557
Cobley, L. S., *Introduction to botany of tropical crops*, 259
Cockrill, W. R., *Antarctic hazard*, 103
Cole, Brig. D. H., obit. of, 422
Cole, M. M., *Land use studies in Transvaal Lowveld*, 399–400
Collins, G., early marine surveyor, 450–1
Collins, J., early marine surveyor, 449
Colombia, aerial survey map, 345; Cordillera Oriental, Cambridge expedn., Society's aid to, 267; EXPLORATION IN NORTHERNMOST ANDES: A. Cunningham, 344–55; German expedn., 345; Sierra Nevada, geology, 350
Colonial Development and Welfare Fund, sponsor of geol. exploration Solomons, 301, 315
Colonial Geological Surveys, Sarawak expedn., 167
Colonial Surveys, Directorate of, equipment loaned to Gough Island Expedn., 22
Commonwealth Weather Bureau, stations on King Id., Tasmania, 476–7
Congo, Belgian, Stanley expedn., Society's aid to, 267
Connell, R. H., remarks on "Some geographical aspects of British Solomon Ids.," 315
Cook, H.M.S., visit to Solomons, 314
Cook, J. G., *World of water*, 257–8
Cornhill Magazine, articles on J. Hornby, I. B. Bishop, Lander brothers and R. Burton, 420
Corsica, central, Expedn. to, Society's aid to, 267
Cotlow, L., *Zanzabuku—dangerous safari*, 250
Cottrell, L., *Seeing Roman Britain*, 240
Coull, J. R., awarded Geogr. essay prize, 559
Courtauld, A., *Man the ropes*, 410
Coverley-Price, V., *Artist among mountains*, 553
Cressey, G. B., *Land of the 500 million*, 92–3
Crone, G. R., Centenary of Alpine Club, 563–6; obits. of L. Bagrow, 575–6; W. A. Cadbury, 421–2; M. Letts, 422
Crouse, N. M., *La Vérendrye*, 113
Cunningham, A., EXPLORATION IN NORTHERNMOST ANDES, 344–55
Cunningham, F., with Andes expedn., 352, 353
Cunningham, R. F. C., remarks on "Surveying aneroids: their uses and limitations," 494
Currie, King Id., Tasmania, wind analysis, 476–7
Customs, H. M., early marine surveying, 453–4
Cuzco, Peru, 437–9
Cyprus: Sir H. Luke, 528; *Land use map:* R. R. Rawson and K. R. Sealey, 528–9

Dams, ancient, in Negev, 181 *et seq.*
Danielsson, B., *Work and life on Raroia*, 255
Denish expedns., *Galathea deep sea expedn.:* ed. A. F. Bruun and others, tr. R. Spink, 558; *see also* Nuristan
Darby, H. C., 'Place-names and geography,' *rev. art.*, 387–92
Dartmoor, weathering and erosion, 503 *et seq.*
Darwin, theory of atoll formation, 301; voyage to Patagonia, 150
Davidson-Houston, Brig., remarks on "Recent developments in Soviet Central Asia," 147
Davidsson, Å., *Handritade kartor över Sverige*, 90
Dawson, 'Memoirs of Hydrography,' 456
"Deepfreeze I," Operation, 1 *et seq.*
"Deepfreeze II," Operation, 115
Deffontaines, P., and M. J.-B. Delamarre, *Atlas aérien*, 411
Delamarre, M. J.-B., *see* Deffontaines P., and M. J.-B. Delamarre
Denizet, R., *see* Berrier, J. C., and R. Denizet
Desert, *see* Negev
Desio, A., Patron's Medal to, 267, 425; presents map of K2 to Society; remarks at A.G.M., 426
Desplanques, H., *see* Bonasera, F.
Dey, A. K., *see* Brown, J. C., and A. K. Dey
Dickson Asia Lecture, 1957, 137–47
Dictionary, Turkish-English (2nd edition): H. C. Hony, 247
Dietrich, G., and K. Kalle, *Allgemeine Meereskunde*, 405
Dixey, F., *East African Rift system*, 540–1; *Erosion surfaces in Africa: some consideration of age and origin*, 249–50; remarks on "Some geographical aspects of British Solomon Ids," 315
Dobby, E. H. G., *Southeast Asia*, 5th edn., 532–3
Dogs, sledge, *see Huskies*
Donacui river, Colombia, 345 *et seq.*

Dongen, I. S. Van, *British East African transport complex*, 539
Douglas, C. E., explorer, *see* New Zealand
Dovers, R., *Huskies*, 251–2
Dovring, F., *Land and labour in Europe*, 241–2
Drage, C., *Chindwin to Criccieth*, 536
Drage, G., life of, *Chindwin to Criccieth:* C. Drage, 536
Dronning Maud Land, Antarctic, gales, 293
Dufek, Rear-Adm. G. F., commander "Operation Deepfreeze I," 1, 11; at Kainan Bay camp-site, 5; telegram to, from Society, 115
Dugdale, G., appointed Assistant Librarian, 268
Duncan, O. D., and A. J. Reiss, *Social characteristics of urban and rural communities*, 406–7
Dune lakes, King Id., Tasmania, 59 *et seq.*
Dunes, Canning Basin, Western Australia, 158–9; King Id., Tasmania, 59 *et seq.*; ON ORIENTATION OF PARABOLIC OR U-DUNES: J. N. Jennings, 474–80
Durham Univ. Expedns., *see* Morocco; Norway; Yugoslavia
Durham Univ. news, by W. B. Fisher, 561–2
Dury, G. H., remarks on "Evolution of relief of Cam valley," 204–5

East, Far, Oxford and Cambridge Far Eastern Expedn., 117
East, Near, *Scheik Ibrahim (Johann Ludwig Burckhardt):* ed. C. Burckhardt-Sarasin and H. Schwabe-Burckhardt, 248
East, Near and Far, *Personal and oriental:* A. Coates, 557
East, W. G., and A. E. Moodie, ed., *Changing world*, 263–5
East Africa, *see* Africa, East
Easter Island: A. Métraux, 546
Eastwind, icebreaker with "Operation Deepfreeze I," 1 *et seq.*
Economist, article on Anglo-Brazilian business relations, 331
Edinburgh, H.R.H. Prince Philip, Duke of, contribution to Gough Island Expedn., 22; presence at Alpine Club Reception, 563; remarks at Annual Dinner, 431–2; visit to Gough Island, 27
Edinburgh Peak, Gough Island, 27, 28
Edisto, icebreaker with "Operation Deepfreeze I," 1 *et seq.*
Edmonds, C. J., SHAR BAHZÊR AND THE BASIN OF THE QALACHUWALAN, 318–28
Eggler, A., and others, Paper 'Swiss ascent of Everest and Lhotse,' read at joint meeting with Alpine Club, 268
Egypt, *Family in Egypt:* M. Rowlatt, 250
El Guardián, Colombia, 349 *et seq.*
Elizabeth II, H.M. Queen, presence at Alpine Club Reception, 563
Elkins, T. H., letter on 'An English traveller in Siegerland,' 135
Embleton, C., remarks on "Physique of Wales," 227
ENGLAND AND WALES, CLASSIFICATION OF SERVICE CENTRES IN: I. Carruthers, 371–85; *Concealed coalfields:* L. J. Wills, 523; *North Wales and Lancashire, Quarter-inch fifth series map: Sheet* 10: Ordnance Survey, 1957, *rev. art.* by L. Harris, 237–9
English, V. H., *see* Klimm, L. E.
'English Pilot,' published 1671, 450
English place-name elements: A. H. Smith, *rev. art.* by H. C. Darby, 387–92
English Place-name Soc., 387, 389, 392
Emmison, F. G., and R. A. Skelton, 'THE DESCRIPTION OF ESSEX,' BY JOHN NORDEN, 1594, 37–41
Enderby Land, Antarctic, gales, 293
Épaulard, A., tr. *Description de l'Afrique*, 538–9
'Essex, Description of,' Mildmay manuscript, 37 *et seq.*
Essex, Earl of, copy of Norden's map, 37
Essex, 'THE DESCRIPTION OF ESSEX,' BY JOHN NORDEN, 1594: F. G. Emmison and R. A. Skelton, 37–41
Ethiopia, Cambridge expedn., Society's aid to, 267; *see also* Africa, East
Europe, *Land and labour in Europe*, 1900–1950: F. Dovring, 241–2
Europe and its borderlands: A. G. Ogilvie, 527–8
Europe, Western: E. D. Laborde, 240; *Report on regional planning in Britain, Netherlands and Germany:* T. J. D. Fair, 240–1
European refugees: M. J. Proudfoot, 396
Evans, C., *Kangchenjunga, untrodden peak*, 83–5; *On climbing*, 83–5
Evans, F., *Voyage of Petula*, 405–6
Everest, East of: E. Hillary and G. Lowe, 93–5
Everest and Lhotse, Paper by A. Eggler and others on Swiss ascent of, 268
Everest-Lhotse adventure: A. Eggler, *rev. art.* by Sir J. Hunt, 521–2
Exploration, history, *Le temps des grands voiliers:* P. J. Charliat, 113

Faber Atlas, letter on, 424
Fair, T. J. D., *Report on regional planning in Britain, Netherlands and Germany*, 240–1
Far East, *see* East, Far
Farmer, B. H., *Pioneer peasant colonization in Ceylon*, 534; PIONEER SETTLEMENT IN SOUTH ASIA (*title only*), 425
Fayein, C., *French doctor in Yemen*, 557
Fechters, P., introd., *Deutschland*, 242
Ferrar Glacier, Antarctic, gales, 293
Fichelle, A., introd., *Russia in pictures*, 242
Finland and its geography: ed. R. R. Platt, 529–30
Fisher, C. A., *see* Steel, R. W., and C. A. Fisher
Fisher, J., *see* Peterson, R. T., and J. Fisher
Fisher, W. B., Durham Univ. news, 561–2
FitzRoy [Patagonia], *Conquest of:* A. Azema, 553
Flaig, W., *Lawinen!*, 548
Florida, *Window in the sea* [oceanarium]: R. N. Hill, 114
Florida group, Solomons, 307, 312
Flying Doctor Service, Western Australia, 163
Fondi, M., *see* Bonasera, F.
Ford, R., *Captured in Tibet*, 535
Forestry, *World geography of forest resources:* ed. S. Haden-Guest and others, 258–9
Foster, M. J. N., OPERATION DEEPFREEZE I, 1–12
Foullon von Norbeeck, H., with *Albatross* Expedn. to Solomons, 300–1
France, *Atlas aérien:* P. Deffontaines and M. J.-B. Delamarre, 411; *La géographie française au milieu du XXe siècle:* ed. G. Chabot and others, *rev. art.* by R. J. H. Church, 235–7; *Caves and cave diving:* G. de Lavaur, tr. E. C. Mason, 549–50; *One thousand metres down:* J. Cadoux and others, tr. R. L. G. Irving, 549–50; *Village in Vaucluse:* L. Wylie, 531–2
Franconia, *Franken:* ed. C. Scherzer, 88
Franklin, happy voyager: G. F. Lamb, 101–2
Fraser, R., *Once round the sun*, 514; *Regard the earth*, 514
French expedns., *see* Adélie, Terre
French West Africa, *see* Africa, French West
Frith, R., remarks on "Surveying aneroids: their uses and limitations," 493–4, 496
Fuchs, V., and British Trans-Antarctic Expedn., 283; dispatch from, 567; given air photograph of Antarctic by Admiral Dufek, 11; message from Society, 115; reconnaissance vehicles, 2; Trans-Antarctic Reconnaissance, 116

Galathea, *see* Danish expedns.
Galbraith, I. C. J., remarks on "Some geographical aspects of British Solomon Ids.," 316

Garland, J. H., ed. *North American Midwest*, 98–9
Garnett, Dr. A., report on Geographical Assocn., 121–2
Gaury, G. de, NOTE ON MASIRA ID., 500–2
Geographer as scientist: S. W. Wooldridge, *rev. art.* by A. A. Miller, 392–4
Geographical Assocn., joint meeting with Inst. Brit. Geogr. and Society, 116; report by A. Garnett, 121–2; spring conference at Matlock, 130
Geographical essay prize, awarded to J. R. Coull, 559
Geographical Magazine Trust Fund, support for Oxford Expedn. to Sarawak, 176; grants by, 284; grant to Stanley expedn. to Belgian Congo, 268
Geographical names, Rendering of: M. Aurousseau, 554–6
Geographical terms, Concise glossary of: J. C. Swayne, 266
Geographisches Taschenbuch, 1956–7: ed. E. Meynen, 130
Geography, Economic, *Chisolm's handbook of commercial geography:* ed. L. D. Stamp and S. C. Gilmour, 110; *Economic geography of industrial materials:* A. S. Carlson, 262; *Economic growth of Brazil, India and Japan:* ed. S. Kuznets and others, 260–1; *Géographie des textiles:* A. Allix and A. Gibert, 553–4; *Introductory economic geography:* L. E. Klimm, O. P. Starkey, J. A. Russell and V. H. English, 110; *Location and space economy:* W. Isard, 551–2; *World economic geography:* E. B. Shaw, 110–11
Geography, Education, *Introduction to world geography:* ed. G. Kish, 262
Geography, Historical, Roman, *Excellent and pleasant works of Caius Julius Solinus:* tr. A. Golding, introd. G. Kish, 265
Geography, Human, *Man's role in changing face of earth, an internat. symposium:* ed. W. L. Thomas, 111–12; publications by Royal Univ. of Lund, 420
Geography, Physical, *Das Gesicht der Erde:* E. Neef, 106–7; *Die Entwicklungsgeschichte der Erde:* ed. H. Thomas, 256
Geography, Political, *Changing world:* ed. W. G. East and A. E. Moodie, 263–5; *Die natürliche Landschaft und ihre räumliche Gliederung:* K. Paffen, 109; *Man-milieu relationship hypotheses in context of international politics:* H. and M. Sprout, 408; *Political geography and world map:* Y. M. Goblet, 108–9; *Politische Geographie:* O. Maull, 551
Geography prizes, awards to schools by Society, 559
Geology, *Jurassic geology of the world:* W. J. Arkell, 105; *Structural geology:* L. U. de Sitter, 256–7; summary of paper 'Structural mosaics and related concepts,' 417
Geomorphology, DIFFERENTIAL WEATHERING AND EROSION ON OLDLANDS: R. S. Waters, 503–9; *Les méthodes de la morphologie:* P. Birot, 402–3; *Quaternary era:* J. K. Charlesworth, *rev. art.* by K. S. Sandford, 517–20
George, P., *La campagne*, 111
Georgia, South, Survey, 1955–56, 117
German expedns., *see* Colombia; Nuristan
Germany, *Deutschland:* introd. P. Fechters, captions by W. Lenz, 242; *Handbuch der naturräumlichen Gliederung Deutschlands:* E. Meynen and J. Schmithusen, 109–10
Germany, East, *Die naturbedingten Landschaften der Deutschen Demokratischen Republik:* J. H. Schultze and others, 109; *Klima Atlas für das Gebiet der Deutschen Demokratischen Republik:* Akademie Verlag, 532
Ghana, *Social organisation of Lowiili:* J. R. Goody, 538
Gibert, A., *see* Allix, A., and A. Gibert
Gilmour, S. C., *see* Stamp, L. D., and S. C. Gilmour
Glacier, icebreaker with "Operation Deepfreeze I," 1 *et seq.*
Glasbury, Wales, 217, 356, 360, 363 *et seq.*
Glastonbury district of Somerset, Soils of: B. W. Avery, 522–3
Glen, The, Gough Island, 23 *et seq.*
Gloucester, H.R.H. Duchess of, opened Alpine Club Exhibition, 563
Gnamma water holes, Canning Basin, Western Australia, 160
Goblet, Y. M., *Political geography and world map*, 108–9
Godwin, H., *History of British flora*, 259–60
Golding, A., tr., *Excellent and pleasant works of Caius Julius Solinus*, 265
Gonçalo Alvarez, first name of Gough Island, 20
Goody, J. R., *Social organisation of Lowiili*, 538
Gorsky, B., '*Moana*,' 114
Gough Id., Base Camp, 23 *et seq.*; birds, 29; census of fur-seal population, 21; discovered by Capt. Gough 1731, 20; fauna, 29; first named Gonçalo Alvarez, 20; GOUGH ISLAND SCIENTIFIC SURVEY: J. B. Heaney and M. W. Holdgate, 20–32; vegetation, 28–9; visited by *Scotia* with Scottish National Antarctic Expd. 1904, 20; visited by *William Scoresby* 1927, 20; weather station, 21, 30
Gould, Sir B. J., obit. by F. M. Bailey, 280–1
Governador Valadares, Brazil, 338; light industries, 339
Graham Land, *Expedition south:* W. E. Anderson, 548
Great Britain, Map of: Ordnance Survey, 527
'Great Britain's Coasting Pilot,' published 1693, 451
Greece, Portrait of: Lord Kinross, 396
Green, C. M., *American cities in growth of nation*, 543–4
Green, H., employed with Gough Island Expedn., 22
Greening, E. F., remarks on "Surveying aneroids: their uses and limitations," 496–7
Greenland, gales, 287 *et seq.*; *Last kings of Thule:* J. Malaurie, 104; *Two against the ice:* E. Mikkelsen, 251; *see also* Iceland and Greenland
Greenland, North, British expedn. to, *North Ice:* C. J. W. Simpson, 250–1
Greenwood, J. E. G. W., DEVELOPMENT OF VEGETATION PATTERNS IN SOMALILAND PROTECTORATE, 465–73
Gregory, S., remarks on "Physique of Wales," 225–6
Grieshaber, H., *Thirty years travelling round the world*, 557
Grove, M. R., with expedn. to Patagonia ice cap, 150 *et seq.*
Grover, J. C., SOME GEOGRAPHICAL ASPECTS OF BRITISH SOLOMON IDS., 298–317
Guadalcanal, Solomons, 298–301, 307, 310
Guatapuri river, Colombia, 345 *et seq.*
Gutenberg, B., and C. F. Richter, *Seismicity of the Earth*, 105–6

Haden-Guest, S., and others, ed., *World geography of forest resources*, 258–9
Hadley, J., early marine surveying instruments, 453–5
Hag's Tooth, Gough Island, 24 *et seq.*
Hall, J. P., cine-photographer and medical officer with Gough Island Expedn., 21 *et seq.*
Hall, R. B., and Toshio Noh, *Japanese geography*, 92
Halley, E., early marine surveying, 451–3
Halley, F. M., and Kurdistan, 318–19, 324, 326
Hamilton, R. A., C. A. Biddle, and B. W. Sparks, SURVEYING ANEROIDS: THEIR USES AND LIMITATIONS, 481–98

Hampshire, Common lands of: L. E. Taverner, 526–7
Hardie, N., *In highest Nepal*, 553
Harris, L., 'Hill-shading in new quarter-inch Ordnance Survey map,' *rev. art.*, 237–9
Harris, M., *Town and country in Brazil*, 99–100
Harrison, J. V., COMPILATION MAP OF PART OF CENTRAL ANDES OF PERU, 33–41
Harrisson, T., Curator Sarawak Museum, 167; assists Oxford Expedn., 168
Hartnoll, C., *Desert welcome*, 543
Hatfield House, copy of Norden's maps preserved at, 37
Hassall, W. O., ed., *Wheatley records*, 956–1956, 524–5
Heaney, J. B., leader Gough Island Scientific Survey, 21 *et seq.*; Mrs. Patrick Ness Award to, 267, 429; remarks at A.G.M., 429–30
Heaney, J. B., and M. W. Holdgate, GOUGH ISLAND SCIENTIFIC SURVEY, 20–32
Hebrides, *Wondrous isle of Staffa:* D. B. MacCulloch, 525–6
Helbig, K. M., *Die Insel Borneo in Forschung und Schrifttum*, 534
"Highjump," Operation, 1
High Plateau, Wales, 209 *et seq.*, 360–1
Hill, R. N., *Window in the sea*, 114
Hillary, Sir E., and G. Lowe, *East of Everest*, 93–5
Hilling, D., letter on 'English traveller in Siegerland,' 135
Himalaya, Ratang-Parbati Himalayan Expedn., 1956, 117; *Where the Gods are mountains:* R. von Nebesky-Wojkowitz, 246
Hindle, E., CARL LINNAEUS AS TRAVELLER, 509–12; remarks at A.G.M., 430
Hiorns, F. R., *Town-building in history*, 406
Holdgate, M. W., third leader Gough Island Scientific Survey, 21 *et seq.*; *see also* Heaney, J. B., and M. W. Holdgate
Holland, M. F. W., obit. by K. S. Sandford, 577–8
Holmes, S. C. A., remarks on "Evolution of relief of Cam valley," 205–6
Holwerda, J. G., *see* Merriam, R., and J. G. Holwerda
Honiara, Solomons, 298–9, 310, 312, 314
Honick, K. R., remarks on "Surveying aneroids: their uses and limitations," 492–3
Hony, H. C., *Turkish-English dictionary (2nd Edition)*, 247
Hooke, R., early marine surveying, 449–53; his quadrant, 449
Hope, S., *Digger's paradise*, 410–11
Hoskins, W. G., *Seven deserted village sites in Leicestershire*, 525
Hotine, Brig. M., remarks on "Gough Island Scientific Survey," 32; remarks on "Surveying aneroids: their uses and limitations," 496
Howard, C., *Mary Kingsley*, 541–2
Huagaruncho, Peru, ascent of, 440–3; Base Camp, 440–2; Peak 30, 441–2
Hunt, Sir J., joint chairman at joint meeting with Alpine Club, 268; remarks on "Exploration in northernmost Andes," 355; 'Swiss on Everest and Lhotse,' *rev. art.*, 521–2
Hurley, F., *Shackleton's Argonauts* (reprint), 253
Huskies, R. Dovers, 251–2
Hutchings, C. E., *see* Wooldridge, S. W., and G. E. Hutchings
Hydrology, *Behaviour and control of rivers and canals:* Sir C. C. Inglis, 257; *World of water:* J. G. Cook, 257–8

Iceland, gales, 292–3; Ice-margin lake in, 127–9; Imperial College expedn., Society's aid to, 267; South-east, Cambridge expedn., Society's aid to, 267
Iceland and Greenland, R.N. Colleges expedn., Society's aid to, 267
Imperial College expedn., *see* Iceland
India, *see* Geography, Economic
India, Pakistan and Burma, *India's mineral wealth:* J. C. Brown and A. K. Dey, 245–6
Indiana Univ., new quarterly journal *Victorian studies*, 277
Indonesia, *Timor problem:* F. J. Ormeling, 533
Inglis, Sir C. C., *Behaviour and control of rivers and canals*, 257
Institut Agricole d'Algérie, ed., *Aspects et réalités de l'Algérie agricole*, 541
Inst. Brit. Geographers, joint meeting with Geogr. Assocn. and Society, 116
Internat. Geogr. Congress, Amsterdam 1938, 335; Antwerp 1871, 335; Rio de Janeiro 1956, 122–5, 329–30, 335–6; Washington 1952, 335
Internat. Geogr. Union, eighth General Assembly, 335; formation, 335; legalization in Brazil, 335; membership, 340–1; *Newsletter*, 274, 341, 566; organization, 340–1; *Proc. eighth General Assembly and 17th Internat. Congress*, 1952: U.S. National Committee (1957), 556; regional conference in Japan, 1957, 125–6
Internat. Geophys. Year, *Guide to I.G.Y.:* British National Committee for I.G.Y.; *Once round the sun:* R. Fraser; *Regard the earth:* R. Fraser; *U.K. contribution to I.G.Y.:* Royal Society; *Geophys. Monograph No. 1. Antarctica in I.G.Y.:* U.S. National Committee for I.G.Y.; *I.G.Y., Meteorological programme:* World Met. Org., *rev. art.* by E. G. R. Taylor, 514–17; investigation of physical phenomena in Antarctica, 11; part taken by "Operation Deepfreeze I," 1
Iran, *see* Persia
'Iraq, North, Oxford and Cambridge Expedn., 1956, 116; WESTERN, AL UMCHAIMIN, CRATER OF POSSIBLE METEORITIC ORIGIN IN: R. Merriam and J. G. Holwerda, 231–3
Irrawady, Return to: F. Kingdon-Ward, 244
Isard, W., *Location and space economy*, 551
Israel, *see* Negev
Isselin, H., *La Meije*, 93–5
Italy, *Ricerche sulle dimore rurali in Italia, Vols. 14 and 15*, 89–90

Jaillot, *see* 'Neptune François'
Japan, *Japanese geography:* R. B. Hall and Toshio Noh, 92; *Picture of:* C. Simpson, 557; *see also* Geography, Economic
Jennings, J. N., COASTAL DUNE LAKES AS EXEMPLIFIED FROM KING ISLAND, TASMANIA, 59–70; ON ORIENTATION OF PARABOLIC OR U-DUNES, 474–80
Johnson, I. and E., *Yankee's people and places*, 410
Jones, O. T., on geology of Wales, 208, 210–11, 217, 219, 356–8

K2, Italian map of, 413
Kafiristan, Afghanistan, 457, 461, 464
Kafirs, Nuristan, 457 *et seq.*
Kainan Bay, Antarctic, 3 *et seq.*
Kalle, K., *see* Dietrich, G., and K. Kalle
Kangchenjunga, untrodden peak: C. Evans, 83–5
Karakorum, Der Chogo-Lungma-Gletscher im: W. Kick, 536–7; Italian map of K2, 413
Kara-Kum project, Soviet Central Asia, 141
Karlbeck, O., *Treasure seeker in China*, 536
Kazakhstan, 137 *et seq.*
Kayan tribe, Sarawak, 168 *et seq.*
Kedar, Y., WATER AND SOIL FROM DESERT: SOME ANCIENT AGRICULTURAL ACHIEVEMENTS IN CENTRAL NEGEV, 179–87
Kelk, C. J., *Netherlands in photographs*, 557
Kemp, N., *Conquest of the Antarctic*, 252–3
Kempe, J. with Huagaruncho expedn., 437 *et seq.*; *see also* Band, G. C., M. H. Westmacott and J. Kempe

Kendrew, W. G. K., and D. Kerr, *Climate of British Columbia and Yukon Territory*, 401
Kenyah tribe, Sawarak, 170, 174–6
Kenton, E., *Black gown and red skins*, 113
Kenya, Adventure begins in: J. Pollard, 542
Kerr, D., *see* Kendrew, W. G. K., and D. Kerr
Kick, W., *Der Chogo-Lungma-Gletscher im Karakorum*, 536–7
Kiel, Geogr. Inst. publications, 572
Kimberleys, Western Australia, 157, 163–4
King Id., Tasmania, coastal dune lakes, 59 *et seq.*; dunes, 474 *et seq.*
Kingdon-Ward, F., *Return to the Irrawady*, 244
Kingsley, Mary: C. Howard, 541–2; *This is your home:* K. Wallace, 96–7
Kinross, Lord, *Portrait of Greece*, 396
Kinzl, Austrian expedn. to Peru, 439
Kirgizia, 137 *et seq.*
Kirk, H., geological expedn. Sarawak, 167; assists Oxford Expedn., 168
Kirsopp, J., with Andes expedn., 351
Kirwan, L. P., obit. of H. U. Sverdrup, 578–9; ROME BEYOND SOUTHERN EGYPTIAN FRONTIER, 13–19
Kish, G., ed., *Introduction to world geography*, 262; introd. *Excellent and pleasant works of Caius Julius Solinus*, 265
Klawe, J. J., letter on Faber Atlas, 424
Klimm, L. E., O. P. Starkey, J. A. Russell and V. H. English, *Introductory economic geography*, 110
Kulam, Nuristan, 459–61, 463–4
Kurdistan, 'Iraqi, Oxford Expedn., 1956, 116; SHAR BAZHÊR AND THE BASIN OF THE QALACHUWALAN: C. J. Edmonds, 318–28
Kurhakazhaw, Kurdistan, 321–5, 327
Krypton, C., *Northern sea route and economy of Soviet North*, 91
Kuznets, S., and others, eds., *Economic growth of Brazil, India and Japan*, 260–1

Laborde, E. D., *Western Europe*, 240
Lamb, G. F., *Franklin, happy voyager*, 101–2
Lamb, H. H., FREQUENCY OF GALES IN ARCTIC AND ANTARCTIC, 287–97
Lamington, Mt., New Guinea, eruption 1951, 314
Lancashire, *see* England and Wales
Landsberg, S. Y., on dunes, 474, 477–8
Lapland, Linnaeus' travels in, 510
Lark, H.M.S., in Solomons, 300
Lartilleux, H., *Géographie universelle des transports*, 87–8
Laszlo, A., *Doctors, drums and dances*, 98
Laurie Id., Antarctic, gales, 289–91
Lavarello, John, employed with Gough Island Expedn., 22
La Vérendrye, *see* Canada
Lavour, G. de, *Caves and cave diving*, 549–50
Lawrence of Arabia: E. Lönnroth, 409–10
Lebanon, *Dog in snow:* J. Riddell, 557
Lee, D. H. K., *Climate and development in tropics*, 403–4
Leicestershire, Seven deserted village sites in: W. G. Hoskins, 525
LeMaitre, R. W., geologist with Gough Island Expedn., 21 *et seq.*
Lendl, E., and others, eds., *Salzburg Atlas*, 243–4
Lenox-Conyngham, Col. Sir G. P., obit. by W. W. Williams, 133–4
Leo Africanus, *Description de l'Afrique*, 538–9
Le Play Soc., plans for visit to Corsica, 130
Le Tourneau, J., founder of Tournavista, Peru, 445–6
Letts, M., obit. by G. R. Crone, 422
Lewis, W. V., Cambridge Univ. news, 561–2; remarks on "Evolution of relief of Cam valley," 206
Lhotse, *see* Everest and Lhotse
Libya, *Desert welcome:* C. Hastnoll, 543
Liddell, R., *Byzantium and Istanbul*, 246
Lima, 437, 443–5, 447; Linguistic Institute, 443–5; Univ. geogr. dept., 330
Lindberg, K., *Voyage dans le sud de l'Iran*, 95–6
LINNAEUS, CARL, AS TRAVELLER: E. Hindle, 509–512
Linton, Cam valley, 188 *et seq.*
Linton, D. L.: obit. of R. N. R. Brown, 576; on geology of Wales, 218–19; on tors, 503, 508; presidential address to British Assocn., 567; remarks on "Physique of Wales," 224–5; ed. *Sheffield and its region*, 87
Lippens, P., *Expédition en Arabie centrale*, 398
Little America, Antarctic base, 1 *et seq.*
Little Hampden, 72 *et seq.*
Llangurig plateau, Wye valley, 358 *et seq.*
Lloyd Anversois, article on A. Ortelius, 418–19
Lobeck, A. K., *Things maps don't tell us*, 265–6
Lombardy, *La casa rurale nella pianura e nella collina Lombarda:* F. Saibene, 89–90
London Univ., Central Research Fund, grant to field work on "Physique of Wales," 220; expedns., *see* Portugal
London's countryside: S. W. Wooldridge and G. E. Hutchings, 394–5
Longhurst, H., *Borneo story*, 96
Lönnroth, E., *Lawrence of Arabia*, 409–10
Lowe, G., *see* Hillary, Sir E.
Lowiili, *see* Ghana
Luke, Sir H., *Cyprus*, 528
Lund, Royal Univ. of, *see* Sweden
Luso-Brazilian Council, conditions for Camoens Award, 420–1
Lyngen, Norway, *Valley of shadows:* N. C. Negri, 252

McAlpine, Capt. L. H., remarks on "Operation Deepfreeze I," 12
MacDonald, M., *Borneo people*, 244–5
MacCulloch, D. B., *Wondrous Isle of Staffa*, 525–6
Macedonia, Cambridge ecological expedn. to, 1956, 117
Macfadyen, W. A., on vegetation patterns in Somaliland Protectorate, 465, 468–9, 472
Mackenzie, M., early marine surveying off Scotland, 454–6; his 'Treatise on Maritim Surveying,' 455; inventor of 'Station Pointer,' 455
Mackenzie, M. (Junior), Head Maritime Surveyor to Admiralty, 455
Mackinder, Sir H., quoted, 284
McMurdo, Antarctic base, 1 *et seq.*
Magga Dan, leaves for Antarctic, 283; message from Society, 115
Magnetism, *Beiträge zur Geschichte der Erkenntnis des Erdmagnetismus:* H. Balmer, 404–5
Mahmud, Shaikh, "King" of Kurdistan, 321; first rebellion, 321; owner of village, 322
Malaita, Solomons, 301, 307, 312, 314
Malaurie, J., *Last kings of Thule*, 104
Maling, D. H., Cartogr. training, at Univ. College of Swansea, 562–3
Manchester and Salford, maps and plans of 1650–1843, 277
Manifold, Major-Gen. Sir C. C., obit. of, 423
Manus, *see* Admiralty Ids.
Marco Polo, Trail of: J. B. Shor, 95
Margary, I. D., *Roman roads in Britain*, vol. ii, 524
Marie Byrd Plateau, Antarctic, 3 *et seq.*
'Marine Surveyor,' *see* Saumarez, H. de
Marret, M., *Antarctic venture*, 102–3
Marriott, Maj. E. H., with expedn. to Patagonia ice cap, 150 *et seq.*
Marshall, E., *Heart of the hunter*, 410
Marshall, R., *Arctic Wilderness*, 104–5

Marshall-Cornwall, Sir J., PRESIDENTIAL ADDRESS, 1957, 283–6; at Annual Dinner of Alpine Club, 563; joint chairman at joint meeting with Alpine Club, 268; MILITARY GEOGRAPHY OF WALES (*title only*), 136; re-elected as President, 430; remarks at A.G.M., 425 *et seq.*; at Annual Dinner, 432–4; on "Operation Deepfreeze I," 11–12; on "Gough Island scientific survey," 31–2; on "Recent developments in Soviet Central Asia," 146–7; on "Patagonia ice cap," 155; on "Usun Apau Plateau," 176–7; on "South American prospect," 341–2; on "Exploration in northernmost Andes," 355; on "Exploration of Huagaruncho: Peruvian journey," 447–8
Marteg, Wye valley, 367, 369
Masira Id., *see also* Oman; derivation of name, 501; fauna, 501; history, 501–2; human and econ. geogr., 500–1; physical geogr., 500
Mason, E. C., tr., *Caves and cave diving*, 549–50
Massey, Rt. Hon. V., address at Annual Meeting Canadian Geogr. Soc., 271
Mather, J. H., obit. by A. Stephenson, 279
Matthews, S., with Huagaruncho expedn., 437 *et seq.*; death of, 447; glacier named in memory of, 447
Maull, O., *Politische Geographie*, 551
Mawer, Sir A., on English place-names, 387, 389–90, 392
Mayne, P., *Saints of Sind*, 247
Mead, M., *New lives for old*, 254
Médicine montagne: J. Rivolier, 408–9
Meije, La: H. Isselin, 93–5
Meinertzhagen, R., becomes C.B.E., 115
Mele, P. F., *Tibet*, 536
Meroe, kingdom of, 13 *et seq.*
Merriam, R., and J. G. Holwerda, AL UMCHAIMIN, CRATER OF POSSIBLE METEORITIC ORIGIN IN WESTERN 'IRAQ, 231–3
Merwe, J. J. van der, meteorologist with Gough Island Expedn., 21 *et seq.*
Mesopotamian plains, recent tectonic movements in, by R. C. Mitchell, 569–71
Métraux, A., *Easter Island*, 546
Meynen, E., ed., *Geographisches Taschenbuch 1956–7*, 130
Meynen, E., and J. Schmithusen, *Handbuch der naturräumlichen Gliederung Deutschlands*, 109–110
Michell, J., early marine surveyor, 454–5
Middleton, D., on Burton and Speke, 413–15
Mikkelsen, E., *Two against the ice*, 251
Mildmay, H. St. J., his manuscript, *see* 'Essex, Description of'
Miller, Prof. A. A., 'High calling of geographer,' *rev. art.*, 392–4; on Wye basin, 356, 358, 369; remarks on "Physique of Wales," 221–3
Mischief, cutter, expedn. to Patagonia ice cap, 148 *et seq.*
Mitchell, R. C., Recent tectonic movements in Mesopotamian plains, 569–71
'Moana' [underwater expl.]: B. Gorsky, 114
Molloy, P., *Cry of fish eagle*, 542
Montevideo, Univ. geogr. dept., 330
Moodie, A. E., *see* East, W. G., and A. E. Moodie
Moore, J., early marine surveyor, 450
Morocco, Report of Expedn. to French Morocco, 1952, by Durham Univ. Exploration Soc., 127
Morris, J., *Sultan in Oman*, 398–9
Moser, B. J., *see* Wood, D. P. J., and B. J. Moser
Moseley, M., article on A. G. Laing in *West Africa*, 578
Morris, L., hydrographic survey of Wales, 453–4
Mountaineering, *Artist among mountains:* V. Coverley-Price, 553; *On climbing:* C. Evans, 83–5; *Picture history of:* R. W. Clark, 83–5
Mountevans, Adm. Lord, obit. of, 578
Mount Everest Foundation, Annual General Meeting, 415; assistance to Andes expedn., 352; established in 1955, 566; its objects, 566; grants by, 267–8, 284; Report and Accounts, 415; support for Gough Island Expedn., 22
Mullock, P. J., radio operator with Gough Island Expedn., 21 *et seq.*
Museu Itamaraty, *see* Rio de Janeiro
Muslims, in Soviet Central Asia, 137 *et seq.*

Nairobi Geogr. Assocn., 575
Naish, G. P. B., 'Navigation from Odysseus to Cook,' *rev. art.*, 85–6
Nanga Parbat Pilgrimage: H. Buhl, 93–5; *Siege of:* P. Bauer, 93–5
Nant-y-Dernol, Wye valley, 363 *et seq.*
Nathan, Lord, remarks at A.G.M., 430–1; address on "Aviation and geography" at joint meeting Geogr. Assocn., Inst. Brit. Geogr. and Society, 116
Natural history, *Mermaids and Mastodons:* R. Carrington, 406
Navigation, *The haven-finding art:* E. G. R. Taylor, 85–6
Nawdari clan, Kurdistan, 321, 325
Near East, *see* East, Near
Nebesky-Wojkowitz, R. von, *Where the Gods are mountains*, 246
Neef, E., ed., *Das Gesicht der Erde*, 106–7
NEGEV, WATER AND SOIL FROM DESERT: SOME ANCIENT AGRICULTURAL ACHIEVEMENTS IN CENTRAL: Yehuda Kedar, 179–87
Negrelli, A. von, *see* Suez Canal
Negri, N. C., *Valley of shadows*, 252
Nepal, In highest [Sherpas]: N. Hardie, 553
'Neptune François,' by Jaillot, early marine survey, 451
Netherlands, *Making of Dutch towns:* G. L. Burke, 88–9; *Netherlands in photographs:* C. J. Kelk, 557
New Georgia Id., Solomons, 307
New Guinea, *Islands of men:* C. Simpson, 100–1; *Last cannibals:* J. Bjerre, 100–1
New Hebrides, *Islands of men:* C. Simpson, 100–1
Newton, Sir Isaac, early marine surveying, 450, 452–3
New Zealand, *Green Kiwi:* T. Sutherland, 100–1; *Mr. Explorer Douglas:* J. Pascoe, 547–8
Nicholson, Gen. Sir C., remarks on "Patagonia ice cap," 156
Nicholson, N. L., Director Geogr. Branch Dept. of Mines and Tech. Surv., Ottawa, 277
Nigeria, Eastern region, population distribution maps of, 416; Northern, air geological survey, 271–4; Letter on patterned ground in, 580
Noh, Toshio, *see* Hall, R. B.
Norden, John, 'The description of Essex,' 37 *et seq.*
North Africa, *see* Africa, North
North America, *see* America, North
Norway, Durham Univ. Expedn. to, 1956, 117; *East, and its frontier:* F. N. Stagg, 556; *Report on solifluction, N.E.A.T.*, 395; SOME INVESTIGATIONS INTO SOLIFLUCTION FEATURES IN NORWAY: P. J. Williams, 42–58; P. J. Williams' expedn., Society's aid to, 267
Norwood, V., *Man alone!*, 100
Noyce, W., 'Untrodden peaks,' *rev. art.*, 83–5
Nubia, ROME BEYOND SOUTHERN EGYPTIAN FRONTIER: L. P. Kirwan, 13–19
Nuristan, Danish and German expedns. to, 457; Nuristanis, 458 *et seq.*; *see also* Afghanistan

Oceanography, *Allgemeine Meereskunde:* G. Dietrich and K. Kalle, 405; *Surveys of the seas:* M. Blewitt, 550–1; *Voyage of Petula:* F. Evans, 405–6; *see also* Danish expedns.
O'Dell, A. C., *Railways and geography*, 261
Odell, N. E., Exhibn. of photographs of New Zealand Alps, 116

Ogilvie, A. G., *Europe and its borderlands*, 527–8
Oldlands, weathering and erosion, 503 *et seq.*
Ollier, C. D., and A. J. Thomasson, ASYMMETRICAL VALLEYS OF CHILTERN HILLS, 71–80
Oman, Dhofar, Oxford expedn., Society's aid to, 267; NOTE ON MASIRA ID.: G. de Gaury, 500–2; *Sultan: in:* J. Morris, 398–9
Ordnance Survey; *Map of Great Britain*, 527; maps of Wales, 209; *Quarter-inch fifth series map: Sheet* 10, *North Wales and Lancashire*, 237
Orford, E. J., obit. by J. F. Unstead, 134
Ormeling, F. J., *Timor problem*, 533
Ortelius, A., article by A. de Burbure on, 418–19,
Ottawa, Dept. of Mines and Tech. Surv., 277
Oxford Expedns., *see* Kurdistan; Oman; Socotra,
Oxford and Cambridge Expedns., *see* East, Far; 'Iraq
Oxford Univ. Expl. Club, *Bulletin*, 415; sponsored expedn. to Sarawak, 176; remarks by K. Sandford on, 177–8
Oxford Univ., news, 118–20
Oxfordshire, *Wheatley records 956–1956:* ed. W. O. Hassall, 524–5

Paffen, K., *Die natürliche Landschaft und ihre räumliche Gliederung*, 109
Pakistan, Agriculture in, by M. J. Webb, 572; *Saints of Sind:* P. Mayne, 247; *see also* India, Pakistan and Burma
Paris, Carte morphologique du bassin de: A. Cholley and others, 530
Pascoe, J., *Mr. Explorer Douglas*, 547–8
Patagonia, air survey, American Air Force, 152; Argentine expedn., 148; PATAGONIA ICE CAP: H. W. Tilman, 148–56; *Wissens. Ergebn. der finnischen Expedn. nach Patagonien 1937–38 und der finnisch-argentinischen Expedn. 1947–53:* V. Auer, 545
Paton, A. A., Trust to assist exploration, Oxford Univ., 178
Penan tribe, Sarawak, 167 *et seq.*
Peneplains, Wales, 208 *et seq.*
Penguins, 251–2
Pênjwin, Kurdistan, 320, 322, 324–5, 327
Pepys, S., and early marine surveying, 451
Percival-Kaye, G., letter on 17th cent. traveller in West Africa, 423–4
Persia, Cambridge North Persian Expedn., 1956, 117; *Voyage dans le sud de l'Iran:* K. Lindberg, 95–6
Peru, British Andean Expedn., 1956, 117; British-operated railways, 438; COMPILATION MAP OF PART OF CENTRAL ANDES OF: J. V. Harrison, 33–41; EXPLORATION OF HUAGARUNCHO; PERUVIAN JOURNEY: G. C. Band, M. H. Westmacott and J. Kempe, 437–48; Kinzl's Austrian expedn., 439; Peruvian Air Force, 440; Peruvian Andes, Cambridge expedns. to, 439, 448
Peterson, R. T., and J. Fisher, *Wild America*, 253
Place-names, English, 387 *et seq.*; French, 391–2; German, 391–2
Planning, regional, International conference on, 415–16
Plant geography, *Introduction to botany of tropical crops:* L. S. Cobley, 259
Platt, R. R., ed., *Finland and its geography*, 529–30
Plieran river and valley, Sarawak, 167 *et seq.*; coal deposits, 171
Plym, Moorland, Dartmoor, 503–4
Polar regions, FREQUENCY OF GALES IN ARCTIC AND ANTARCTIC: H. H. Lamb, 287–97; table of gale frequencies, 295–6
Polish Geogr. Soc., *Górny Śląsk*, 531
Pollard, J., *Adventure begins in Kenya*, 542
Polynesia, *Adventures in Paradise:* W. Price, 100–1
Polynesians, Solomon Ids., 299, 301–2, 304
Poeta, A., *see* Bonasera, F.
Portugal, Geologia de: ensaio bibliografico, 577–8; London Univ. speleological expedn. to, 267
Prestrud Inlet, Antarctic, 6 *et seq.*
Price, W., *Adventures in Paradise*, 100–1
Priestley, Sir R., obit. of Capt. V. L. A. Campbell, 131–2; withdraws from nomination as President, 430
Procter, W. A., with expedn. to Patagonia ice cap, 148 *et seq.*
Proudfoot, M. J., *European refugees*, 396
Proudfoot, V. B., letter on "Patterned ground in Nigeria," 580
Provence: M. Brion, tr. S. G. Colverson, 242
Pucallpa, Peru, 443 *et seq.*
Punta Arenas, Patagonia, 148 *et seq.*; British colony, 151
Pyramid, peak, Peru, ascent attempted, 439–40

Qalachuwalan river, Kurdistan, 319 *et seq.*
Quest, visited Gough Island 1922, 20, 25, 27
Quinteros, J., with expedn. to Patagonia ice cap, 151 *et seq.*

Radnor Forest, 209, 211, 215, 358, 361
Rahman, A., Amir of Afghanistan, 457, 461, 464
Railways and geography: A. C. O'Dell, 261
Rajang river, Sarawak, 167 *et seq.*
Ramgul, Nuristan, 459–60, 463–4
Raroia [Oceania], *Work and life on:* B. Danielsson, 255
Rawson, R. R., and K. R. Sealey, *Cyprus land use map*, 528–9
Red Sea, underwater exploration, *Dahlak:* G. Roghi and F. Baschieri, 114
Reinheim, Dovrefjell, Norway, solifluction terraces, 42 *et seq.*
Reiss, A. J., *see* Duncan, O. D., and A. J. Reiss
Rennell, Lord, remarks at Annual Dinner, 434–5
Rennell Id., Solomons, 301–5
Repetto, Ernest, employed with Gough Island Expedn., 22
Rhayader, Wye valley, 358, 360, 362 *et seq.*
Rice, R. J., EROSIONAL HISTORY OF UPPER WYE BASIN, CENTRAL WALES, 356–70; remarks on "Physique of Wales," 226
Richter, C. F., *see* Gutenberg, B.
Riddell, J., *African wonderland*, 250; *Dog in snow*, 558
Rio de Janeiro, 336 *et seq.*; Internat. airport, 337; Internat. Geogr. Congress at, 329–30, 336; Museu Itamaraty, rare maps in, 574
Ritchie, S. G., remarks on "Some geographical aspects of British Solomon Ids.," 316
Rivolier, J., *Emperor penguins*, 252; *Médicine montagne*, 408–9
Roberts, B., 'Australian map of Antarctica,' *rev. art.*, 82–3
Robertson, Sir G. S., first European in Nuristan, 457, 460; his 'Kafirs of the Hindu Kush,' 460
Robinson, A. H. W., MARINE SURVEYING IN BRITAIN DURING SEVENTEENTH AND EIGHTEENTH CENTURIES, 449–56
Roghi, G., and F. Baschieri, *Dahlak*, 114
Rogers, A., employed with Gough Island Expedn., 22
ROME BEYOND SOUTHERN EGYPTIAN FRONTIER: L. P. Kirwan, 13–19; addenda and amendment, 271
Ross Sea, gales, 290–3, 295; Shackleton's party, 8, 9
Rowett, Mount, Gough Island, 26, 27
Rowlatt, M., *Family in Egypt*, 250
Royal Air Force, assistance to Oxford Expedn. to Sarawak, 170–1, 173
Royal Australian Air Force, air photos of Canning Basin, Western Australia, 162

Royal Geogr. Soc., Annual Dinner, 431–6; Annual General Meeting, 425–31; assistance to Andes expedn., 352; donation from Mrs. F. K. Wilson, 115, 430; equipment loaned to Gough Id. expedn., 22; establishment research studentship, 115, 283; exchange of messages with *Magga Dan*, 115; exhibitions 1956–57, 284; grants to expedns. 1957, 267; joint meeting with Alpine Club, 268; with Geogr. Assocn. and Inst. Brit. Geogr., 116; *Journal* a hundred years ago, 81, 234, 386, 513; Officers and Council, 412; PRESIDENTIAL ADDRESS, 1957: Sir J. Marshall-Cornwall, 283–6; quotation from *Wiadomosci Geograficzne*, 115–16; special meetings and films in 1956, 116; support for Oxford expedn. to Sarawak, 167, 176; telegram to Adm. Byrd, 115
Library, Soviet geographical serials in, 127, 276, 419, 574
Royal Inst. of Internat. Affairs, publications on South America, 330
Royal Inst. of Chartered Surveyors, gold medal and prize of 100 guineas initiated by, 130
Royal Meteorological Soc., support for Gough Island Expedn., 22
Royal Navy, observations on Solomons, 314
R.N. Colleges expedn., *see* Iceland
Royal Netherlands Tropical Inst., 299
Royal Society, and early marine surveying, 449 *et seq.*; *United Kingdom contribution to I.G.Y.*, 514
Royston, Cam valley, 188 *et seq.*
Russell, J. A., *see* Klimm, L. E.
Russia, *see* U.S.S.R.

Saffron Walden, 188 *et seq.*
Saibene, F., *La casa rurale nella pianura e nella collina Lombarda*, 89–90
St. George Id., Solomons, 312, 314
Salford, *see* Manchester
San Cristoval, Solomons, 307, 309–10
Sand, Canning Basin, Western Australia, 159; Simpson's desert, South Australia, 159
Sandfly, H.M.S., massacre of crew in Solomons, 300
Sandford, K. S., 'Charlesworth's Quaternary era,' *rev. art.*, 517–20; obit. of M. F. W. Holland, 580–1; remarks on "Usun Apau Plateau," 177–8
Santa Cruz group, Solomons, 298, 301
Santa Ysabel, Solomons, 301, 307, 312–14
Santiago, Chile, Univ. geogr. dept., 330
São Paulo, geographers, 330; population, 329
Sarawak, Geological Dept., 174; Geological Surveys, 167; Govt., support for Oxford Expedn., 167; Oilfields (Shell) Ltd., support for Oxford Expedn., 167; Oxford expedn. to, USUN APAU PLATEAU: G. Arnold, 167–78
Saumarez, H. de, early survey of Channel Ids., 452; inventor of "Marine Surveyor," 452–3
Savigear, R., *see* Africa, French West
Savo Volcano, Solomons, 314
Scheidl, L. G., 'Wiener geographische Schriften,' 420
Scherman, K., *Spring on an Arctic island*, 104
Scherzer, C., ed., *Franken*, 88
Schmithüsen, J., *see* Meynen, E.
Schofield, A. N., remarks on "Some investigations into solifluction features in Norway," 57
Schreiber, Don R. R., Peruvian Ambassador, remarks on "Exploration of Huagaruncho: Peruvian journey," 448
Schultze, J. H., and others, *Die naturbedingten Landschaften der Deutschen Demokratischen Republik*, 109
Schwabe-Burckhardt, H., *see* Burckhardt-Sarasin, C., and H. Schwabe-Burckhardt
Scientific Film Assocn., *Review*, 420
Scoresby, W., 1790–1857, note by T. E. Armstrong, 269–70
Scotland, early marine surveying, *see* Mackenzie, M.
Scott, A., with Andes expedn., 352–3
Scott Polar Research Institute, support for Gough Island Expedn., 21–2
Scottish National Antarctic Expedition 1904, 20
Scottish universities, news, 268–9
Scott's Hut, Antarctic, 3, 7, 8
"Seabees," United States construction battalions in Antarctic, 12
Sealey, K. R., *see* Rawson, R. R., and K. R. Sealey
Seismicity of the earth: B. Gutenberg and C. F. Richter, 105–6
Seller, J., early hydrographer, 450
Shabad, T., *China's changing map*, 92
Shackleton, film record of Trans-Antarctic Expedn., 116; Ross Sea party, 8; *Shackleton's Argonauts* (reprint): F. Hurley, 253
Shackleton range, Antarctic, 566
Shar Bazhêr, 'Iraqi Kurdistan, 318 *et seq.*
Shaw, E. B., *World economic geography*, 110–11
Shaw, S. H., remarks on "Surveying aneroids: their uses and limitations," 492
Shebbeare, E. O., obit. of H. W. Tobin, 280
Sheffield and its region: ed. D. L. Linton, 87
Sheppard, P. A., remarks on "Surveying aneroids: their uses and limitations," 490–1
Sherpas, *see* Nepal
Shewell, Brig. H. A. L., remarks on "Surveying aneroids: their uses and limitations," 491, 495–6, 498
Shor, J. B., *Trail of Marco Polo*, 95
Short, J. P., remarks on "Surveying aneroids: their uses and limitations," 496
Shortland Ids., Solomons, 306–7
Siegerland, letters on travel in, 135
Sierra Nevada, Andes, 344 *et seq.*
Silesia, Upper, *Górny Śląsk:* Polish Geogr. Soc., 531
Simons, F. A. A., Andes explorer, 344 *et seq.*
Simons, Pico, Andes, 345
Simpson, C., *Islands of men*, 100–1; *Picture of Japan*, 557
Simpson, C. J. W., *North ice*, 250–1
Sinclair, D. J., ed., *Faber atlas*, 112–13
Singh, R. L., *Banaras*, 91
Sinnhuber, K. A., On A. Negrelli, forgotten designer of Suez Canal, 575–6
Sitter, L. U. de, *Structural geology*, 256–7
Skelton, R. A., *see* Emmison, F. G.
Skolle, J., *Road to Timbuctoo*, 97–8
Slessor glacier, Antarctic, 566
Smith, A. H., *English place-name elements*, 387–92
Smith, E., remarks on "Some investigations into solifluction features in Norway," 55–7
Smith, G., with Huagaruncho expedn., 445–6
Snowdon, 208–9, 211, 214, 219
SOCOTRA, OXFORD EXPEDN. TO: D. L. Botting (*title only*), 425
Soil Survey of England and Wales, 73, 470
Solari, F., remarks on "Surveying aneroids: their uses and limitations," 495
Solifluction, in Norway, 42 *et seq.*
Solinus, Caius Julius, Excellent and pleasant works of: tr. A. Golding, introd. G. Kish, 265
Solomon Ids., agriculture, 299; BRITISH, SOME GEOGRAPHICAL ASPECTS OF: J. C. Grover, 298–317; Chinese in, 299; climate, 298; Europeans in, 299–300; people, 299–300; Central, 307–14
SOMALILAND PROTECTORATE, DEVELOPMENT OF VEGETATION PATTERNS IN: J. E. G. W. Greenwood, 465–73
South African Trigonometrical Survey Office, equipment loaned to Gough Island Expedn., 22
South African Weather Bureau, equipment loaned to Gough Island Expedn., 22; takes over Gough Id. station, 30

South America, *see* America, South
South Ice, Antarctic depot, 567
"South Pole," Antarctic base, 1
Soviet Central Asia, Recent developments in: G. E. Wheeler, 137–47
Soviet geographical serials in Society's library, 127, 276, 419, 574
Soviet Union, *see* U.S.S.R.
Sparks, B. W., Evolution of relief of Cam valley, 184–207; *see* Hamilton, R. A., C. A. Biddle and B. W. Sparks
Speke, J. H., *see* Burton, Sir R. F.
Spelaeological Soc., Proceedings of, 1955–56: Bristol Univ., 107–8
Spitsbergen, Cambridge expedn., Society's aid to, 267; gales, 288–9
Sprout, H. and M., *Man-milieu relationship hypotheses in context of international politics*, 408
Stagg, F. N., *East Norway and its frontier*, 556
Stamp, L. D., as President Internat. Geogr. Union, 336; *Asia*, 397; Brazil; a geographer's view, 335–40; obit. of D. G. Whittlesey, 132–3; remarks on "Evolution of relief of Cam valley," 203
Stamp, L. D., and S. C. Gilmour, *Chisholm's handbook of commercial geography*, 110
Stanford, Messrs. E., map publications, 130
Stanley expedn., *see* Congo, Belgian
Stanley, H. M., *I presume:* I. Anstruther, 96–7
Stark, Freya, lecture on "Minor battlefields of Alexander," 116
Starkey, O. P., *see* Klimm, L. E.
Steel, R. W., and C. A. Fisher, ed., *Geographical essays on British tropical lands*, 262–3
Steers, J. A., remarks on "Physique of Wales," 221, 230; on "Some geographical aspects of British Solomon Ids.," 315, 317; on "Some investigations into solifluction features in Norway," 56, 58; South America as field for geographical research, 329–35
Stenton, Sir F., on English place-names, 387, 389, 392
Stephenson, A., obit. of J. H. Mather, 279
Sternberg, H. O'R., Organizing Secretary 18th Internat. Geogr. Congress in Brazil, 335
Stone mounds, ancient, Negev, 184–5
Stonehouse, B., lecture, "Antarctic adventure to-day," 116
Streetly, J., with Husaruncho expedn., 437 *et seq.*
Sudan, *Cry of fish eagle:* P. Molloy, 542; census, by W. P. G. Thompson, 568–9
Suez Canal, forgotten designer of [A. von Negrelli], by K. A. Sinnhuber, 573–4
Sulaimani, 'Iraqi Kurdistan, 318 *et seq.*
Surveying instruments, Early marine, 449 *et seq.*
Surveying, Marine, *see* Britain
Sutherland, T., *Green Kiwi*, 100–1
Sverdrup, H. U., obit. by L. P. Kirwan, 578–9
Sverdrup, O., monument to, 558
Swales, M. K., zoologist with Gough Island Expedn., 21 *et seq.*
Swansea, Univ. College of, D. H. Maling on cartogr. training at, 562–3, news, 120–1
Swayne, J. C., *A concise glossary of geographical terms*, 266
Sweden, *Handritade kartor över Sverige:* Å. Davidson, 90; North, Research Group (University College, London), 1956, 117; Royal Univ. of Lund, publications on human geogr., 420
Sweeting, M., remarks on "Physique of Wales," 223–4
Swithinbank, Dr. C., remarks on "Some investigations into solifluction features in Norway," 57
Sydney: M. Barnard, 546–7
Sydney Univ., geol. exploration Solomons, 301, 314
Tadzhikistan, 137 *et seq.*
Tajiks, Nuristan, 458 *et seq.*
Tasmania, Coastal dune lakes as exemplified from King Island, Tasmania: J. N. Jennings, 59–70
Taverner, L. E., *Common lands of Hampshire*, 526–7
Taylor, D., *Ten stars south of Asia*, 546–7
Taylor, E. G. R., *Haven-finding art*, 85–6; 'Operation I.G.Y.' *rev. art.*, 514–17
Tellurometer system of distance measurement, Summary of paper by T. L. Wadley, 126–7
Terry, M., Canning Basin of Western Australia, 157–66
Thesiger, W., Journey in Nuristan, 457–64
Thomas, H., ed., *Die Entwicklungsgeschichte der Erde*, 256
Thomas, W. L., ed., *Man's role in changing face of earth, an internat. symposium*, 111–12
Thomasson, A. J., *see* Ollier, C. D.
Thompson, Prof. E. H., remarks on "Surveying aneroids: their uses and limitations," 489, 491–8
Thompson, Sir G., remarks on "South American prospect," 342–3
Thompson, W., remarks on "Surveying aneroids: their uses and limitations," 497
Thompson, W. P. G., Sudan census, 568–9
Tibesti, Cambridge expedn., Society's aid to, 267
Tibet: P. F. Mele, 536; *Captured in:* R. Ford, 535; *No passport to:* F. M. Bailey, 399; *Prisoner in red:* S. Wignall, 535–6
Tilman, H. W., Patagonia ice cap, 148–56; Founder's Medal, 155
Tobin, H. W., obit. by E. O. Shebbeare, 280
Togoland, *Black mistress:* J. Bernard, 250
Tors, Dartmoor, 503 *et seq.*
Tournavista, Peru, 445–6; experimental farm, 446
Town-building in history: F. R. Hiorns, 406
Toy, B., *Fool in the desert*, 97
Transports, Géographie universelle des: H. Lartilleux, 87–8
Transvaal Lowveld, Land use studies in: M. M. Cole, 399–400
Transvaal, South African frigate, relieves Gough Island Expedn., 30
Travel, *Yankee's people and places:* I. and E. Johnson, 410
Travelling round the world, Thirty years: H. Grieshaber, 557
Trinity House, early marine surveying, 450–2
Tristan da Cunha, Development Company, 22; discovered by Portuguese, 20; and Gough Island Expedn., 22 *et seq.*
Trollheimen, Norway, solifluction terraces, 42 *et seq.*
Tropics, Climate and development in: D. H. K. Lee, 403–4; Meeting of Commission on humid tropics, 419–20
Tucker, J., with Huagaruncho expedn., 437 *et seq.*
Tunisia, *Le territoire des Ouled Sidi Ali Ben Aoun:* A. Bessis and others, 541
Tupari, see America, South
Turkmenistan, 137 *et seq.*
Turkey, *Byzantium and Istanbul:* R. Liddell, 246
Turner, D. B., *see* Chapman, J. D., and D. B. Turner
Tuscany: A. von Borsig, introd. and notes R. Bianchi-Bandinelli, 242
Tyrrell, J. B., obit. of, 579

Umbria, *La casa rurale nell' Umbria:* F. Bonasera, H. Desplanques, M. Fondi and A. Poeta, 89–90
U.S.S.R., exchange of printed material with Soviet institutions, 130–1; *Northern sea route and economy of the Soviet North:* C. Krypton, 91; *Russia in pictures:* introd. A. Fichelle, tr. L. Gifford, 242; *see also* Soviet Central Asia

United States, Marine Corps, fuelling system Operation Deepfreeze I, 9; National Committee, *Internat. Geogr. Union, Proc. Eighth General Assembly and 17th Internat. Congress*, 1952, 557–8; National Committee for I.G.Y., *Geophysical Monograph No. 1, Antarctica in I.G.Y.*, 514; U.S.A.A.F., assistance to Andes expedn., 532
University news, 118, 268, 560
Unstead, J. F., obit. of E. J. Orford, 134
Urban and rural communities, Social characteristics of: O. D. Duncan and A. J. Reiss, 406–7
Usun Apau, Sarawak, 167 *et seq.*
Uzbekistan, 137 *et seq.*; Bulletin of Uzbek branch of Geogr. Soc. of U.S.S.R., 421

Vane, M., *Black magic and white medicine*, 542–3
Van Tromp, J., expedn. to Patagonia ice cap, 150 *et seq.*
Vaucluse, *see* France
Venezia, 396–7
Vienna, Geogr. Soc. of, 558

Wace, N. M., botanist with Gough Island Expedn., 21 *et seq.*
Wadley, T. L., TELLUROMETER SYSTEM OF DISTANCE MEASUREMENT, Summary of paper, 126–7
WALES, CENTRAL, EROSIONAL HISTORY OF UPPER WYE BASIN: R. J. Rice, 356–70; hydrographic survey, *see* Morris, L.; MILITARY GEOGRAPHY OF: Gen. Sir J. Marshall-Cornwall (*title only*), 136; PHYSIQUE OF: E. H. Brown, 208–30; *see also* England and Wales
Wallace, K., *This is your home*, 96–7
Wallis, J. P. R., obit. of, 580
Walton, K., lecture "Antarctic adventure today," 116
Waters, R., remarks on "Physique of Wales," 224
Waters, R. S., DIFFERENTIAL WEATHERING AND EROSION ON OLDLANDS, 503–9
Watts, J. E. M., *Equatorial weather*, 107
Webb, M. J., Agriculture in Pakistan, 572–3
Weddell Sea, Antarctic, 9; gales, 290–3, 295
Welsh, D., leaves Society's service, 268
West Africa, *see* Africa, West
West Australian Petroleum Co., Ltd. [Wapet], 157 *et seq.*
West Indies Univ. College, Andes expedn., 346
Western Australia, *see* Australia, Western
Westmacott, M. H., with Huagaruncho expedn., 437 *et seq.*
Wheeler, G. E., RECENT DEVELOPMENTS IN SOVIET CENTRAL ASIA, 137–47
Wheeler, Sir M., and R.G.S. Studentship, 283; lecture on "East Africa's ancient past," 116; survey of Roman exploration, 13
Whittle, G., remarks on "Some geographical aspects of British Solomon Ids.," 315, 316
Whittlesey, D. S., obit. by L. D. Stamp, 132–3
Wiadomosci Geograficzne, quoted, 115
Wickenden, J., *Beyond the high savannahs*, 100
Wignall, S., *Prisoner in red Tibet*, 535–6
Wilkinson, P., remarks on "Surveying aneroids: their uses and limitations," 497
Williams, P. J., SOME INVESTIGATIONS INTO SOLIFLUCTION FEATURES IN NORWAY, 42–58
Williams, W. W., obit. of Col. Sir G. P. Lenox-Conyngham, 133–4; remarks on "Surveying aneroids: their uses and limitations," 494–5
Wills, L. J., *Concealed coalfields*, 523
Wilson, Mrs. F. K., donation to Society, 115, 430
Wise, M. J., Meeting of British Assocn., 566–8
Wolff, T., with *Galathea* Expedn. to Solomons, 302, 305, 314
Wollaston, A. F. R., and Mrs., Andes explorers, 344 *et seq.*
Wollaston, N., *Handles of Chance*, 247
Wood, D. P. J., and B. J. Moser, CAMBRIDGE EXPEDN. TO NORTH BORNEO (*title only*), 425
Wooldridge, S. W., *Geographer as scientist*, 392–4; on English place-names, 389; on geology of Wales, 208; remarks at A.G.M., 427; on "Evolution of relief of Cam valley," 203; on "Physique of Wales," 223; Victoria Medal to, 267, 427
Wooldridge, S. W., and G. E. Hutchings, *London's countryside*, 394–5
Wordie, Sir J. M., Knighthood for, 115
Wright, J., *United States and Canada*, 98
Wright, J. W., remarks on "Surveying aneroids: their uses and limitations," 498
Wye valley, 211, 214–15, 217, 356 *et seq.*
Wylie, L., *Village in Vaucluse*, 531–2

Yemen, *French doctor in:* C. Fayein, 557
Yugoslavia, Durham Univ. Expedn. to, 1956, 117
Yukon Territory, *see* British Columbia

Zetland, Marquess of, *Essayez*, 409
Zierer, C. M., ed., *California and southwest*, 401–2
Zoppi, Count, at A.G.M., 430

INDEX TO MAPS AND PLANS

BRITISH ISLES

Bristol Channel, Part of survey, by M. Mackenzie, 455
Cam valley, geology, 189; Saffron Walden river, 200; terraces, 190, 193; western plateau, 197
Chiltern Hills, slope map of area near Chesham, 73; soil series and contour maps of Little Hampden and Chesham, 75
Devonshire, northern Dartmoor, 505
England and Wales, service centres, 373, 375, 377, 379–81, 385
Essex, Norden's MS. map, 38
Milford Haven, Survey of, by L. Morris, 1748, 453
Surrey, "Chart" names, 390
Wales, drainage, 218; erosion surfaces, 210; High Plateau, Gwy and Rhudd surfaces, 359; Newbridge depression, major surfaces, 362; upper Wye basin, 357
Warwickshire, wood names, 391
Welsh coast, Chart of, by L. Morris, 1748, 454

EUROPE

Norway, part of Blåhø solifluction terrace area, 43

ASIA

Afghanistan, Nuristan, 580
Borneo, Sarawak, 168; Usun Apau plateau, 169, 173
Central Asia and Kazakhstan, industry, 138
East, Middle, 231
Hindu Kush, Mir Samir, 458
'Iraq, 570; Al Umchaimin depression, 232
Israel, Negev, 179
Kurdistan, 'Iraqi, Shar Bazhêr, 318
Oman, Masira Id., 502

AFRICA

Egypt and Sudan, Roman military stations, 14
Nigeria, Eastern, population, 416
Nigeria, Northern, 272

AMERICA, SOUTH

Patagonia, 149; Ice cap, 151
Peru, Central Andes, 136; Cordilleras Vilcabamba and Blanca, 442; Huagaruncho massif, 447; Northern Andes, 344, 346, 348

AUSTRALASIA AND PACIFIC

Australia, Western, Canning basin, 158
Solomon Ids., British, 298; bathymetric map, 302; Bellona Id., 306; Central, 308; Guadalcanal and Florida Group, 311; Rennell Id., 303; San Cristoval, 309; Savo volcano, 313
Tasmania, King Island, dunes, 475; dune lakes and lagoons, 62, 63, 65, 67, 68; morphological features, 60

INDEX TO ILLUSTRATIONS AND DIAGRAMS

BRITISH ISLES

Britain, early marine surveying instruments, 452
Cam valley, sketch sections, 192, 195, 197, 199
Chiltern Hills, Chesham, 72; diagrams of asymmetrical valleys, 77; Little Hampden valley, 74
Devonshire, Moorland Plym, 504
Kemp, W., morris-dancing from London to Norwich, 38
Wales, Elan and Claerwen valleys, 217; Erwood Gorge, height-range diagrams, 363, 366; High Plateau, 216; Prescelly monadnock and low peneplain, 217; profile diagrams, 212–13, 215, 216; Upper Wye profile diagrams, 364, 368; Wye headwater streams, profile diagram, 360

EUROPE

Norway, solifluction, diagrams, 47, 49, 50, 53, 55; terraces, Blåhø, 44, 46; Reinheim, 46, 47; Rondane, 47

ASIA

Afghanistan, Nuristan, 462, 463; Nuristanis, 459
Borneo, Sarawak, Kayans hut-building, 168; Long Luar, airdrop, 168; Plieran river, 168; Usun Apau plateau, 169
Israel, Negev, dams, 184, 185; Ovdat (Aboda), 184

AFRICA

Somaliland, Vegetation patterns, 468–9, 472–3

AMERICA, SOUTH

Patagonia, Bismark glacier wall in Lake Argentino, 154; Calvo glacier, *Mischief* anchored, 151; Cape Froward, 150; Ice cap, looking north across Calvo glacier, 155; Peel Inlet, 151, 154
Peru, Central Andes, Nevada Tunshu, 35; Pacific slope, 34, 35; Mantaro basin, 34; Huagaruncho, 443, 446; Northern Andes, 354; Bolívar and Colón, 354; El Guardián, 355; Mama of Donacui, 355; rock-carvings, 355; Tairona peaks, 354

AUSTRALASIA AND PACIFIC

Australia, Western, Canning basin, sand dunes, 160; Eil Eil Springs, 161; Lake Dora, salt crust, 160; sandhills, 161
Solomon Ids., boulder beach rampart, 314; fringing reef, 314; Honiara, 315; Malaita, waterfall, 315; profile diagrams, 305–6, 312–13

POLAR REGIONS

Antarctica, Capt. Hawkes and Rear-Adm. Dufek at South Pole, 11; *Glacier* at full power, 6; refuelling aircraft, 7; LGP D-8 Tractor, 10; Rawin tower and met. hut at Hut Point, 10; Tankers at Hut Point, 7
Gough Id., Base Camp, 21; Deep Glen, 21; Edinburgh Peak, 28; Hag's Tooth, 20; Kerguelen fur-seal, 29; surveying on Hag's Tooth, 28; yellow-nosed Albatross, 29

MAPS AND PLANS—*cont.*

POLAR REGIONS

Antarctic, gale frequencies, 290; I.G.Y. stations, 2; Kainan Bay, 4; long range flights, 10; McMurdo Sound, 7
Arctic, gale frequencies, 287, 289
Gough Island, 30
Greenland, gales, 294

GENERAL

Linnaeus' pupils, journeys of, 511

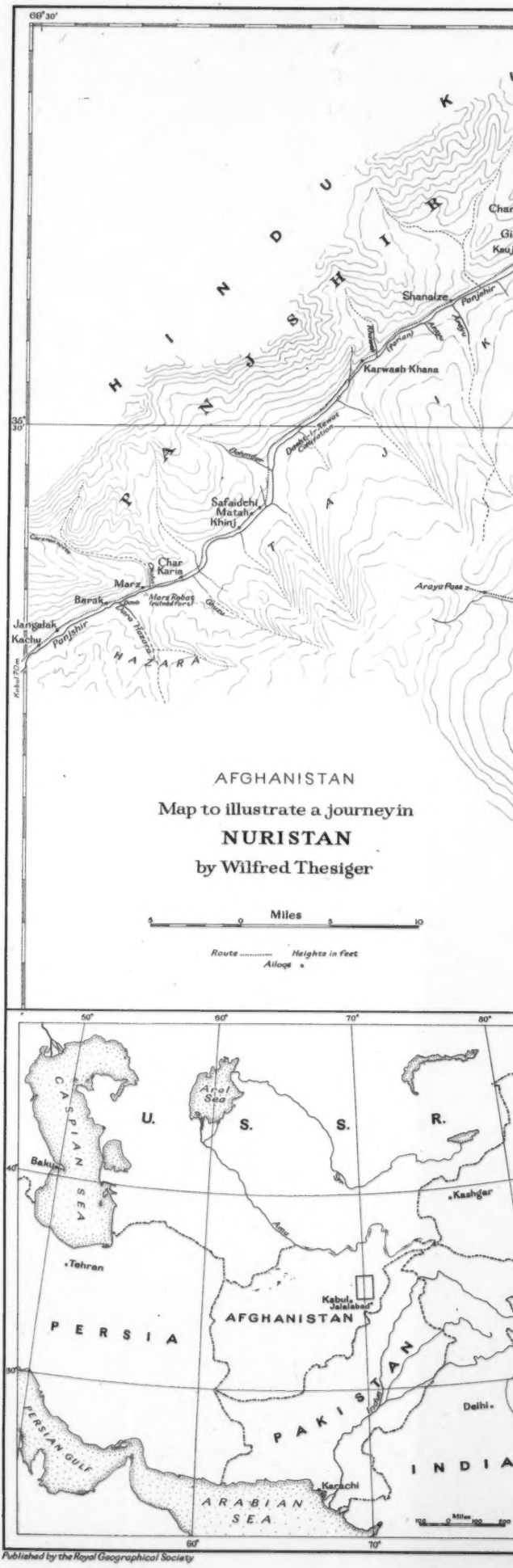
ILLUSTRATIONS AND DIAGRAMS—*cont.*

GENERAL

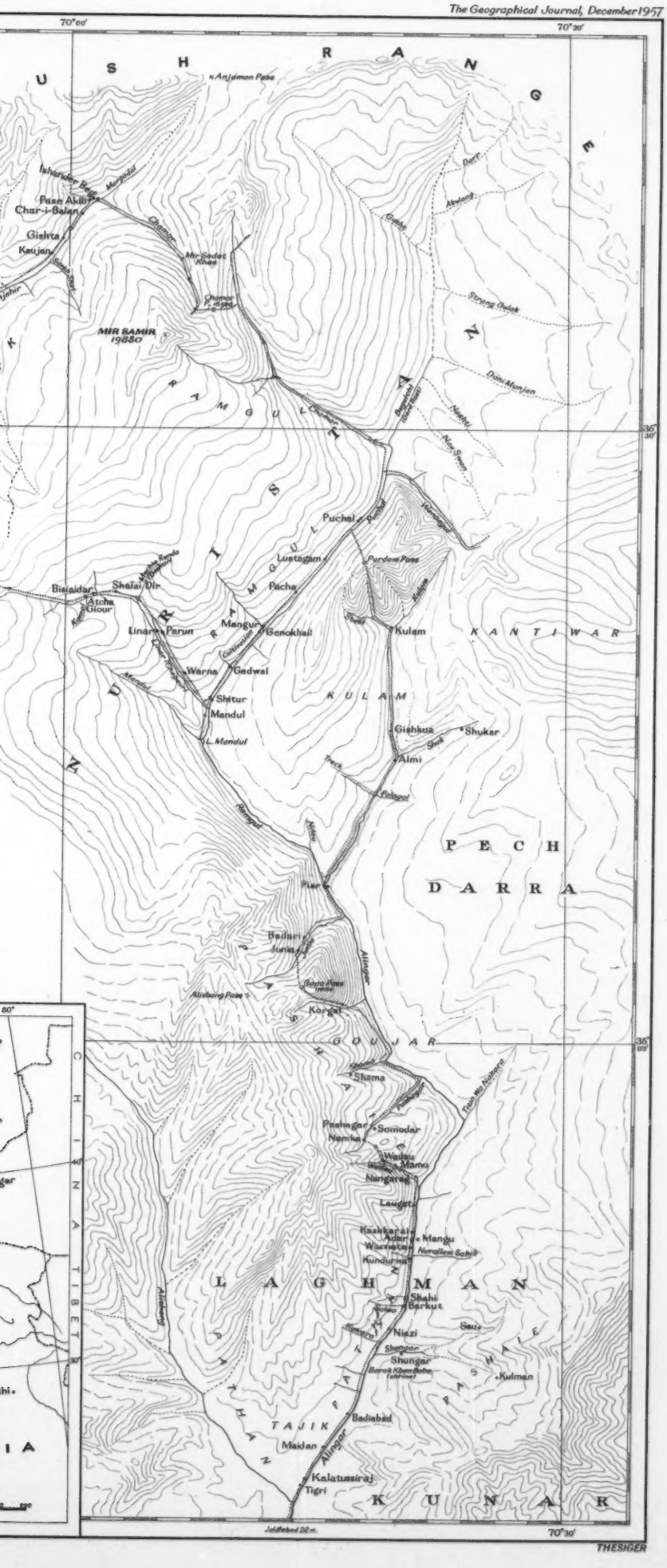
Aneroids, land surveying diagrams, 485–6
Burton, Sir R. F., 414
Byrd, Adm. R. E., 278
Scoresby, W., in 1822, 270
Speke, J. H., 415
Survey, experimental model of Master Tellurometer, 126

END OF VOL. CXXIII

MADE AND PRINTED FOR THE ROYAL GEOGRAPHICAL SOCIETY BY
WILLIAM CLOWES AND SONS, LIMITED, BECCLES, ENGLAND



Published by the Royal Geographical Society


70°00'
70°30'
H I N D U K U S H
R A N G E
Anjoman Pass
Ishpander Pass
Marjanda
Pass Akbil
Char-i-Balan
Gishta
Kaujan
Shahr Pass
Jahir
Chamar
Mir Sadat Khan
Chamar
MIR SAMIR
19880
Darr
Ahdang
Gulak
Shrang Gulak
Dami Munjan
Nagahil
Nur Sheen
Bandak (Dorf Pass)
R A M G U L
Chamar
Puchal
Puchal
Homagal
Lustagam
Purdam Pass
Kalam
Pacha
Shalai Dir
Bisaidar
Atche
Glour
Linare
Parun
Mangur
Genokhail
Kulam
K A N T I W A R
Warna
Gadwal
Shitur
Mandul
L. Mandul
K U L A M
Gishkua
Shukar
Almi
Track
Kalagal
Ronagal
Nisar
Pisar
P E C H
D A R R A
Badari
Jurna
Alishang
Alishang Pass
Korgal
G O J U R
Shama
Chichil
Kandagal
Tsuh Wa Nasara
Pashagar
Nanika
Somodar
Wasnu
Mamu
Nangarez
Laugar
Kashkar-ki
Adari
Mangu
Wazwaz
Nawalem Sahib
Kundurma
L A G H M A N
Shahi
Barkut
Niazi
Saus
Shungar
Barak Khan Baba (shrine)
Kulman
Badiabad
Maklan
Alingar
Kalatussiraj
Tigri
K U N A R
Jalalabad 22 m.
70°30'
THESIGER
80°
40°
30°
C H I N A
T I B E T